The International ARMS REVIEW

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A Jolex PUBLICATION

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Dear Reader,

The International Arms Review is a new form of yearbook, a work that combines the talents of an international team of distinguished firearms authorities whose writings explore all phases of firearms history and firearms development. It is a book designed to appeal not only to those who carry guns as occupational tools but also to those interested in marksmanship, hunting and collecting, however casually.

The scope of this volume is virtually unlimited: within these covers the reader will find features ranging from highly technical themes to interesting tales describing the people or circumstances responsible for noteworthy events. Some of our material has even been gathered from mothballed archives where our team of researchers found illuminating information on historically famous specimens. The latest developments in the world of guns have also been examined.

Future editions, you may be sure, will continue the pattern we have introduced here and, hopefully, will establish a new level of sophistication in firearms-oriented literature. Your comments and suggestions are therefore welcomed and will serve to direct our future efforts.

Sincerely,
JOLEX, INC.

John Olson

JOHN OLSON, PRESIDENT

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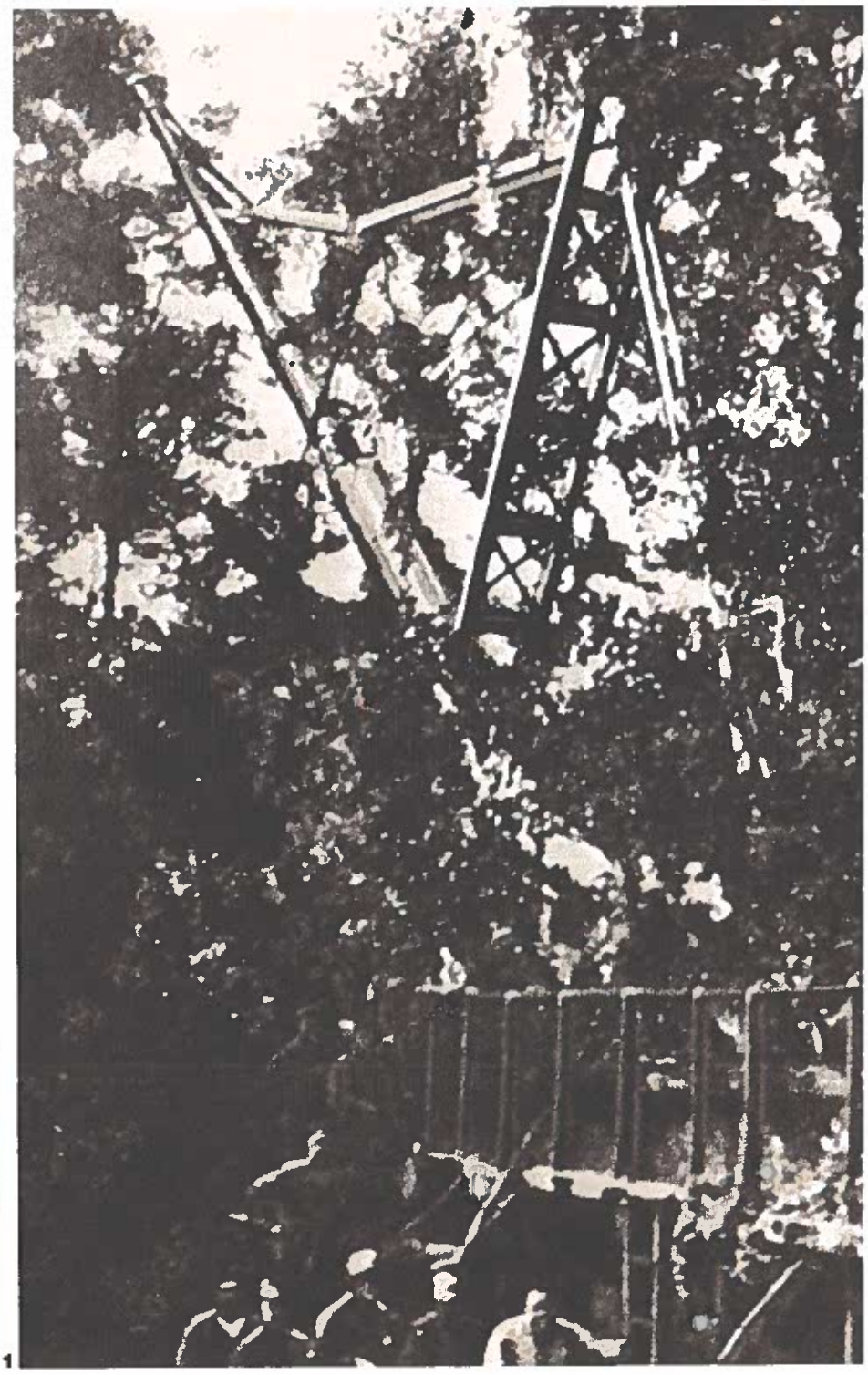
Text and Photos: K. D. Meyer

The Giant Siege

HOW IT STARTED

It was 1918, the last year of the "big war". The Germans were preparing for the last all-out attack against the Allied lines. Germany still thought she might be victorious. The British were badly suffering from defeats at the Somme and near Saint Quentin, the French, figuratively, were bleeding to death. The morale of the Allies was low. And then it happened!



1 *Siege gun ready to fire. Note excellent camouflage, which, in conjunction with artificial fog, prevented the use of aerial photography.*

2 *The three-stage shell compared with height of an average soldier. The shell weighing 104 kg, the charges 196 kg.*

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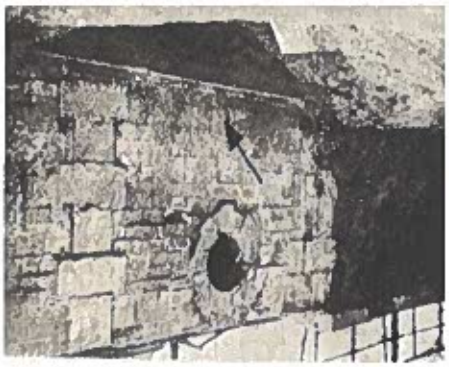
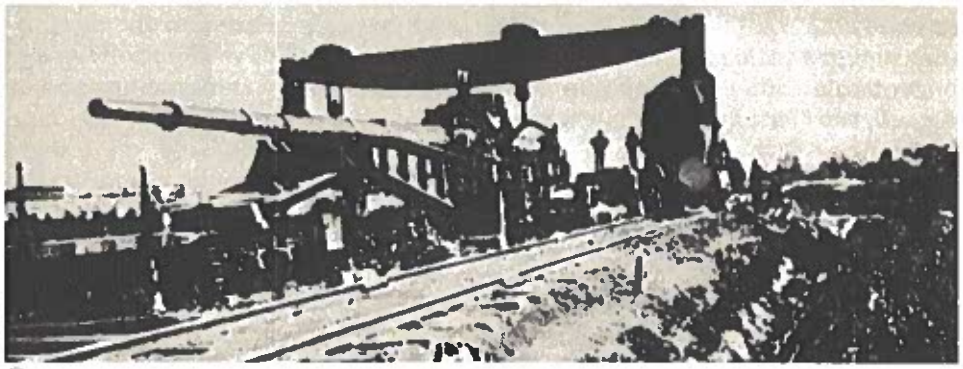
Guns of Paris



3 *A crater at the Quai de Seine.*



4 *The siege gun is so mammoth in size that two 12 m segments of the barrel are taken down for transportation, with the aid of an accompanying crane.*

Saturday, March 23, 1918. The sun is shining bright over Paris. The Germans are a hundred and thirty kilometres away; there is not an enemy plane in the sky.

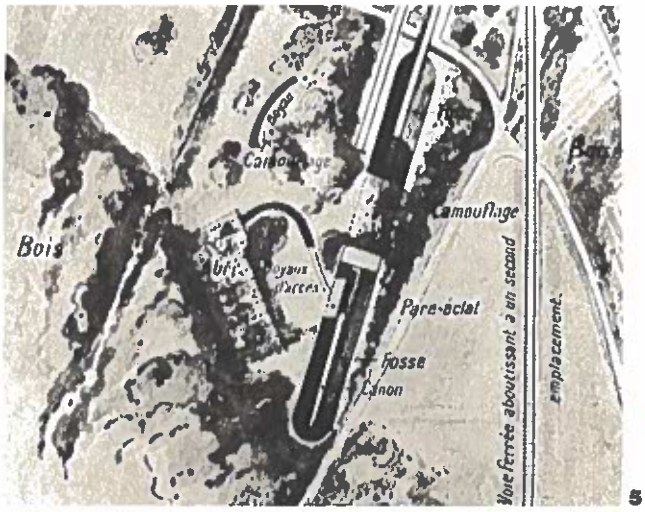
Suddenly, at 7:20 a.m. an explosion ruptures the silence. At No. 6 Quai de Seine pavement stones are pitched into the air. An aerial bomb? At 7:40 a.m., in the Boulevard de Strasbourg, right in front of the Town Hall, a fountain of stone also flies skywards. When the dust settles 8 dead and 13 wounded are found under the debris.

At 8:05 a. m. a house in the Rue du Chateau Landon, No: 12, is hit, minutes later a house at 15 Rue Charles Cling goes up in smoke. Further detonations follow with monotonous regularity.

By 2:45 p.m. 25 sites in Paris had been hit.

In the city panic is threatening to break out. People are rushing to the stations and to the roads leading out of Paris. The weirdest of rumors are in circulation. Some claim a German zeppelin, high out of sight in the sky, is shooting torpedoes into the capital. Others believe that grenades are being fired at them from underground mortars behind the French lines. On one point everyone agrees: The Huns are pounding Paris to bits.

In the meantime, however, the French have not been idle. Their experts investigated the craters and found steel splinters more than 5 cm thick and fragments of copper bearing rifling marks. These were obviously parts of shells.



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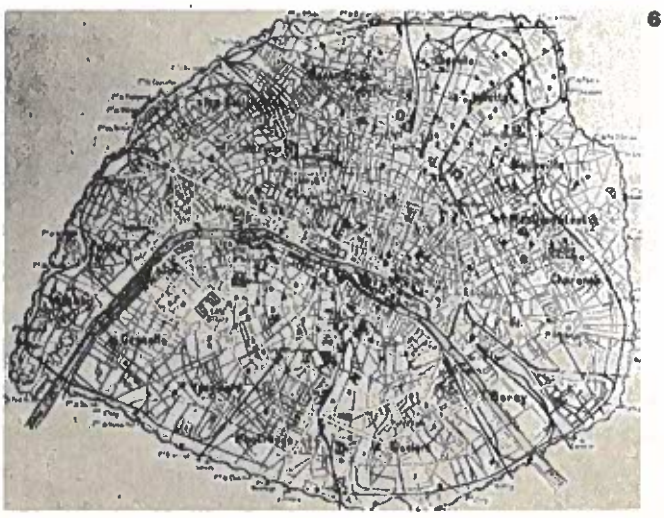


5 *French sketch showing the presumed positions of siege guns.*
6 *Map of Paris pin-pointing with black dots where shells have landed.*

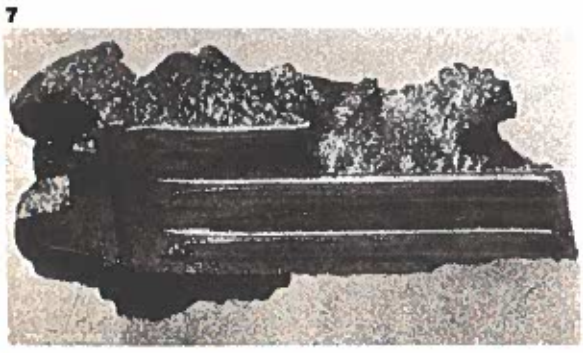
At 4 p.m. it is officially announced that the Germans are besieging Paris with a 240 mm long-distance gun. General Mochot, an artillery officer, emphatically pointed out that the Germans were 125 km from Paris, and that no one, not even the Germans, could construct a weapon to fire shells over that distance. "That is technically and ballistically impossible," he snorted. Other experts expressed themselves a little more cautiously, saying, "It's very improbable, but as far as gun technology is concerned, the Germans have given us a surprise or two before."

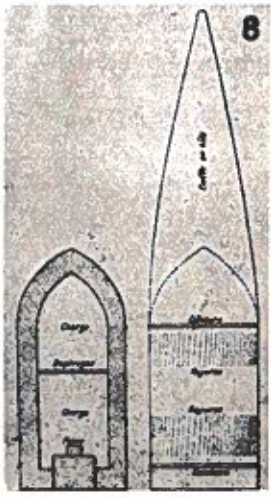
At the beginning of the war Belgian and French concrete fortifications, deemed impregnable, crumbled and fell under the concentrated fire of the now famous Big Bertha.

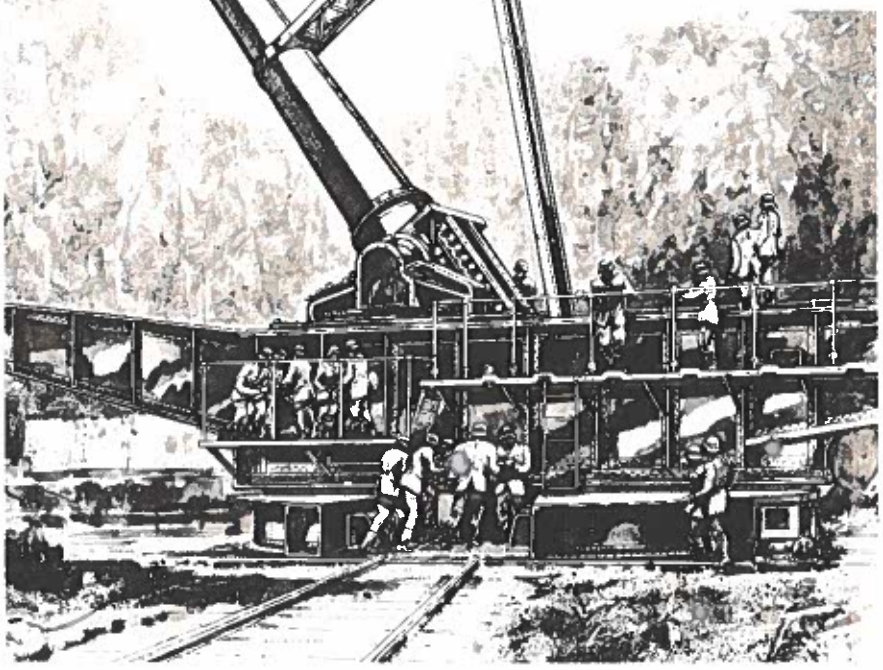
And Long Tom, the Langer Max in German, a railway gun with a 17 m barrel, cal. 38 cm, fired a 240 kg shell on Dunkirk, over an unbelievable distance of 47 km.

Meanwhile the Germans are still bombarding Paris; on the next day, Palm Sunday, and on Monday. Then followed three days of silence.

Ballisticians and artillery experts record each hit on a map. It was found that all the shells had dropped alongside an imaginary line running north-east through the city. This line, projected towards the enemy's position, indicated that the gun had to be







7 *Segment of a shell found in Paris. Note deep rifling.*
8 *For the scientists, the segment of the shell provided clues to the shell's original size. Their reconstruction came very close to reality.*
9 *The siege gun being readied for action. The suspension type scaffolding helps reinforce the 34 m barrel.*

somewhere in the wood of Saint Gobin, not far from the town of Laon. Observation aircraft reported a bank of fog over this area, and a sound-ranging party confirmed that very heavy artillery was being fired from this district. Here they must be, the monsters who are butchering Paris!

The distance from Notre Dame, the center of Paris, to the assumed German big-gun position was 125 km. In 1918 even an aeroplane could not cover this distance in less than an hour.

On Good Friday the bombardment of Paris resumes.

At 4:36 p.m., during mass, a shell hits the main pillar of the Saint Gervais church, killing 151 people.

The French muster all available 30 cm railway guns, sending them to Saint Gobin, as near the wood as possible. They cannot see the German gun, nor its muzzle flash, and have to rely on information fed them by the sound-ranging party. However, the Germans had set up a whole battery of smaller guns to fire with the siege gun. This, of course, misdirected the sound-ranging party.

The Siege Gun

In 1916 Professor von Eberhardt, one of the masterminds of the Krupp concern, began theorizing on the ballistics of long-distance artillery. The distance a shell can be fired is limited by drag, which increases almost proportionally to the square of the shell's velocity and the earth's gravitation. Nothing could be done about gravitation, but what about air drag? Drag is dependent on atmospheric pressure, and this sinks linearly the further the distance from the earth. At about 40,000m drag has dropped to zero.

A mortar would have to be built that fired its projectiles up into the thin layer of the earth's atmospheric envelope. Once the shell had reached this height gravitation would bring it back to earth. Prof. von Eberhardt computed that by firing a shell at a specific angle into the stratosphere he could reach a target on earth about 100 km away. Muzzle velocity of this giant gun would have to be about 1600 mps, substantially more than that of any other siege gun. But the Professor was not to be deterred by such "trifles". His plans were made known to the Army Supreme Command, and Hindenburg and Ludendorff petitioned Krupp to construct the gun as quickly as possible.

So the gun was made. Its constructor, Dr. Rausenberger, created a cross between a piece of artillery and a mortar. This monstrosity defied description, as well as the laws of ballistics.

The bottom section was made up from a 38 cm navy gun, into which a 21 cm calibre barrel was inserted. This inserted barrel consisted of three parts; the first 10 m, the second and third each 12 m long.

The two 12 m sections were mounted at the battle site by means of an accompanying crane. Complete, the barrel measured 34 metres. Quite an imposing length! To prevent the barrel from sagging, a suspension bridge type scaffolding ran practically the length of the barrel. The flatcar, similar to the undercarriage of the railway guns, was in itself 7.50 m high. The gun weighed 140 tons, and was manned by 80 naval gunners and officers.

Ammunition

The ammunition for this heavy gun was made up of two sections, as is usual with big artillery shells. In other words, the projectile and the charge were separate, and not "fixed" as in small arms. One might think this rather a hindrance, but it has advantages in that the parts are easier to handle and the charge can be varied according to the range to be covered. Contrary to what the French had calculated, the Paris siege gun was calibrated for 210 mm, not for 240 mm shells. The shells (explosive type), weighing a mere 104 kg, deviated from normal construction. Instead of copper bourrelets or bands, they were fitted with two steel bourrelets having corresponding grooves and lands cut to match the barrel rifling. A narrow copper gasket nestled snugly behind each band to make for a perfect fit. When loading, the shell was revolved until its lands lined up with the grooves of the barrel; one might say the shells were then screwed into place. The explosive shells were all equipped with two detonators: one in the base, the other in the nose of the projectile. There was not a single dud during the whole of the Paris campaign.

The charge was housed in a three-part container. The bottom section was of brass and contained 70 kg of gunpowder, the middle section formed a closed silk bag with 75 kg of powder, and the top section was an open silk bag with approx. 51 kg of gunpowder. From the open bag in the top section powder could be increased or decreased according to internal or external ballistic influences, such as atmospheric pressure, wind speed, temperature or barrel wear. The container or case measured 2.80 m, and the projectile 1.10 m.

The high gas pressure, the temperature of combustion (approx. 2000 ° C.), and the terrific muzzle velocity (1600 mps, or approximately 5280 ft. per. sec.) caused excessive erosion. The life of the barrel was very short. Every shot fired slightly increased the size of the bore, which would have negatively influ-

enced the guns accuracy. However, this factor was taken into account and pre-calculated. The shells were numbered, and each shell of the follow-up number was a little larger than the one before. Compensation for weight differences was made by stepping up the charge or by changing the angle of the barrel, or both.

Positioning the guns

As with everything else, the sites for the first three siege guns had been meticulously selected. The first site chosen was the wood not far from Crépy, a location really ideal for placing a big gun. Approaching from Laon via Cerney-les-Bucy the open plain gave way to high wooded countryside just after Crépy. Between Crépy and Fourdrain, behind a wooded hill, thee siege guns were lined up 1 km apart. The German troops were waiting 10 km to the front. The railway line Laon – La Fere – Ham was only three kilometres behind the guns. Each siege gun was connected to the main line so that provisions and ammunition could be easily transported.

In November 1917 German sappers, in addition to building concrete bunkers, had started to dig out three gun sites with a wall extending 100 m. The three giants all arrived about the same time. Two of them being cemented in place, a technique similar to that used for the railway guns.

In a radius of a few kilometres, large-calibre railway guns were also positioned, which, when fired, distracted the French from the true danger.

Firing the giants

Very new and revolutionary was the method for adjusting to the target. The normal approach with a new gun is to test fire it until one has collected enough data, apart from the rough guidelines worked out by the factory, but test firing was impossible with these long range siege guns in time of war. Anyway, the Germans wanted to hit the bull's eye with the first shot so as to land a psychological shock on their enemy. There was no alternative but to calculate every shot in advance, mathematically. From beginning to end everything rested on theory. Atmospheric pressure at various heights, temperatures at various heights, wind speed and wind direction, the curvature of the earth, as well as its rotation, etc. had to be considered to obtain the right formula. But the only control instrument the siege guns actually had was a gasometer, whereby the gunner could read off gas pressure and say that the last shot had either gone too far or fallen short of its target. To land a shell in the middle of Paris the gas pressure had to be 4000 kg/sq. cm with the barrel at a 50°angle. Fine adjustments were achieved by slightly altering the angle of the barrel and by increasing or decreasing the charge, as mentioned earlier. After 25 secs. the projectile had reached a height of 19,200 m and still had a speed of 900 mps. After another 65 secs. the shell, at 38,500 m, reaches its meridian, and, curving sharply, falls toward Paris. The detonation occurs on an average 2 min. 56 secs. after the gun has been fired.

The moment a siege gun has been fired the crew feverishly set about their individual tasks. The breechblock is opened to eject the glowing shell case, and the barrel, trembling like a straw in the wind, is wound down to the horizontal for re-loading. Despite the suspension bridge type scaffolding the 34 m barrel has to be re-aligned with pulley blocks. But it is not long before the naval gunners get the hang of everything. The barrel is given a couple of minutes to cool off and is hastily elevated again. In theory 6 shots can be fired in an hour. In practice, however, only about two shots were fired per hour.

Five-month bombardment

The Parisians were exposed to the German siege guns from March 23 to August 9, 1918. During this period the guns had to be relocated three times. In other words the Paris bombardment can be split into four phases.

Phase 1

Saturday, March 23, gun No. 1 opens fire. Sunday, March 24, gun No. 3 follows suit. Monday, the 25th, gun No. 3 explodes, killing very nearly the entire crew. Friday, March 29, gun No. 2 joins in. The third shot of this gun demolishes a section of the Saint Gervais church. In the meantime gun No. 1 is worn out, and is dismantled. On April 6, after 48 shots, gun No. 2 is worn out, and is awaiting a replacement barrel. On April 11, only five days later, gun No. 2 begins to fire with its new barrel. On May 1, gun No. 2 has worn out its second barrel, this time after 64 shots.

In the meantime the German front has moved closer to Paris, and it is decided to move the siege guns, too. One of the guns was transported by rail to an emplacement south of the Somme, between Flavy-le-Martell and Beaumont-en-Baine, in the middle of a wood only 105 km from Paris.

Phase 2

After a pause of 25 days the guns start firing again on May 27. Up to June 11 Paris is hit 104 times. Then, as the French were doing their utmost to capture them, the guns had to be withdrawn.

Phase 3

On account of the May offensive the Germans had regained so much ground that a gun could be placed only 87 km from Paris. The emplacement was between Fere-en-Tardenois and Chateau Thierry, not far from Ville-de-Tardenois. Firing began on July 16, but on July 18, after only 14 shots, the gun crew had to be evacuated to Beaumont, for the French had crushed the German front with tanks.

Phase 4

On August 5, from Beaumont, firing recommenced. However, on August 9 the Allies put an end to the German bombardment of Paris, which within the last five days had been hit another 64 times.

A total of 365 shells landed on Paris, nearly all within the city boundary, in fact within an area measuring 3 x 15 km.

When retreating, the Germans blew up the three siege guns, not one of them was captured. According to the Treaty of Versailles all the machine tools and plans for manufacturing these guns had to be destroyed.

Further developments

The reader will want to know what happened when the curtain dropped on WWI. The French, after a while, claimed they had designed similar giant siege guns; of course, better than the German ones. These were believed to stand on the Channel coastline, pointing towards England.

At that the English protest vehemently, and a short time later assert that they, too, have giant guns, pointing at France. No documents have ever been found to validate these claims. Probably neither nation had gone to the expense and trouble of building such monsters.

The only further development we know of was the German K 12, another giant that was completed in 1940. It had a bore of 21 cm, a barrel length of 41.1 m, and was mounted on oversized railway flatcars. It weighed 375 tons. With a muzzle velocity of 1625 mps, the 107 kg shell was propelled to a target 140 km away. This was an improvement in big guns, admittedly, but it was also the last of its line. In fact, the K 12 never saw service.

Today, the era of Gustavs, Big Berthas and Long Toms has decidedly gone, what with screaming jets on the one hand, and those deadly intercontinental rockets on the other...

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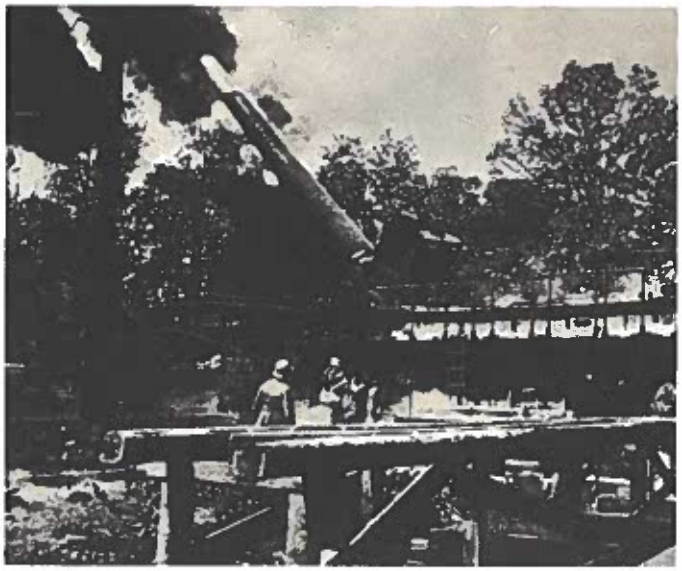

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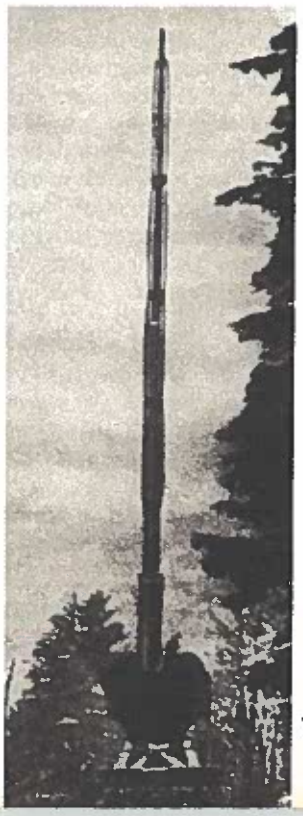

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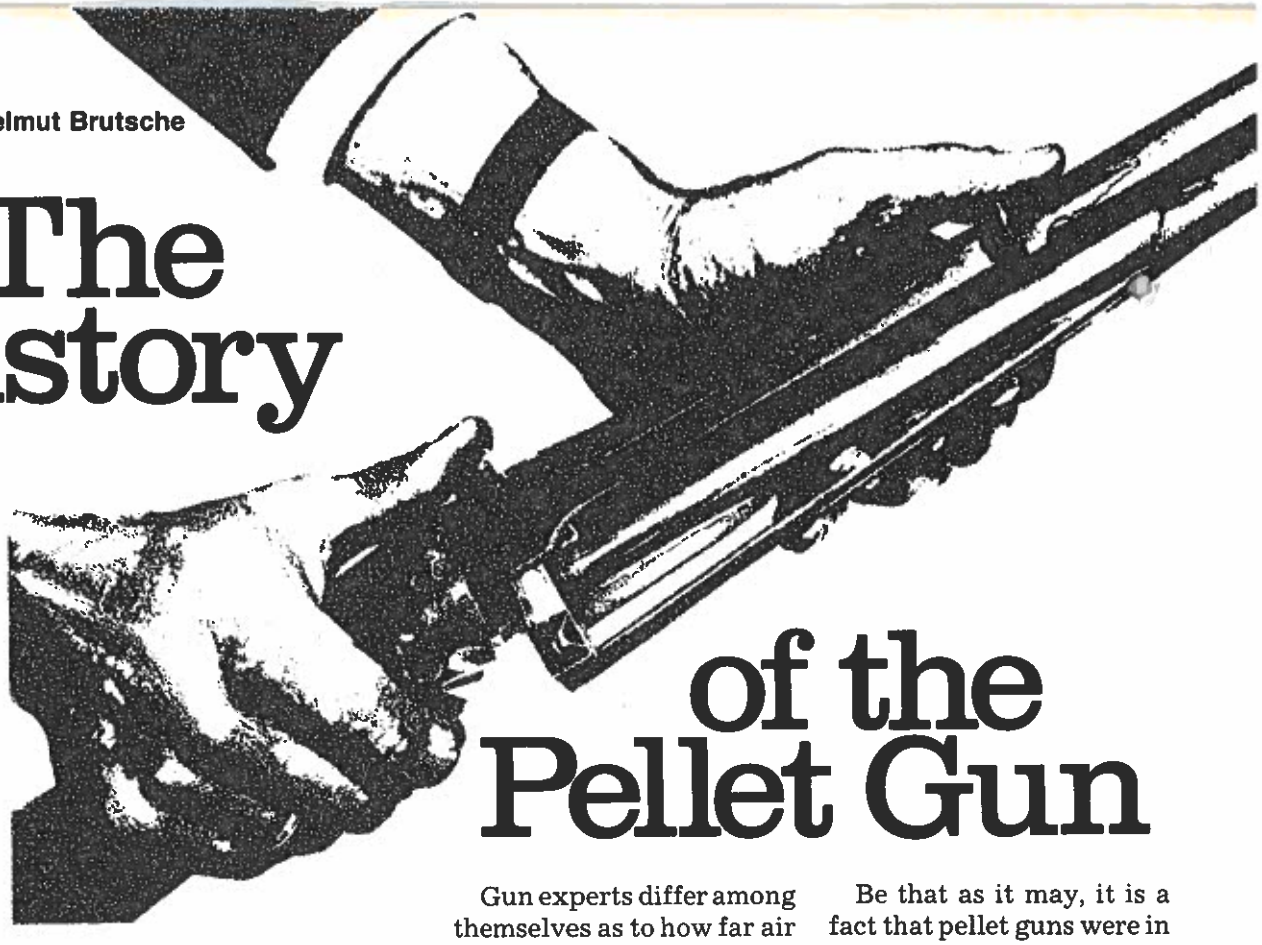
10 *Big Bertha retired to a museum. This is the mortar that crushed the "impregnable" Belgian and French giant concrete fortifications. Its calibre is 42 cm.*
11 *Long Tom, the hurler of 240 kg grenades, being prepared for the next shot.*
12 *Long Tom (cal. 38 cm) giving Dunkirk a pasting, a town 47 km away.*
13 *The K 12 of WW2. Barrel length 41.1 m, total weight 375 tons, range 140 km.*

Helmut Brutsche

The History of the Pellet Gun



Gun experts differ among themselves as to how far air arms go back in history.

According to August Demmin, in "Enzyklopädie der Kriegswaffen," Leipzig, 1886, Guter in Nuremberg invented the air gun in 1430. F. M. Feldhaus calls this in question, claiming that a Hans Lobsinger offered the aldermen of Nuremberg his air gun in 1556. Then again, I. B. Porta describes in his "Magia naturalis," 1589, an air weapon with a brass cylinder for containing compressed air. Yet another Nuremberger, Peter Dümbler, designed in 1607 a gun that "goes off without a bang, and penetrates a board a thumb thick." The city fathers forbade its manufacture, since "a murderous weapon as such could kill a man without his knowing whence the shot came."

Fig. 1 *An iron stirrup pump for filling the cylinders.*

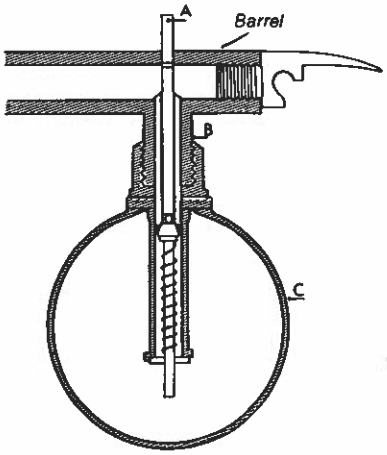
Be that as it may, it is a fact that pellet guns were in use well over 400 years ago, so we shall now concern ourselves with the types available and their mode of function.

Contrary to conventional firearms, air is used to propel the bullet (pellet) out of the barrel. In earlier models the air was pressed into the cylinder with a strong iron pump, similar to the first bicycle pumps, the form and application of which will be discussed later (Fig. 1).

The cylinder relief valve was rod-connected with the trigger. A short, sudden action opened the valve to release a pre-proportioned amount of air through the barrel (Fig. 2).

Some authorities maintain that these guns had to be pumped 200 strokes to reach working pressure (Demmin: 200 atm.), others

Fig. 2 *A spherical air cylinder screwed to underside of the barrel. A) Connecting rod, B) Manifold, C) Compressor cylinder*



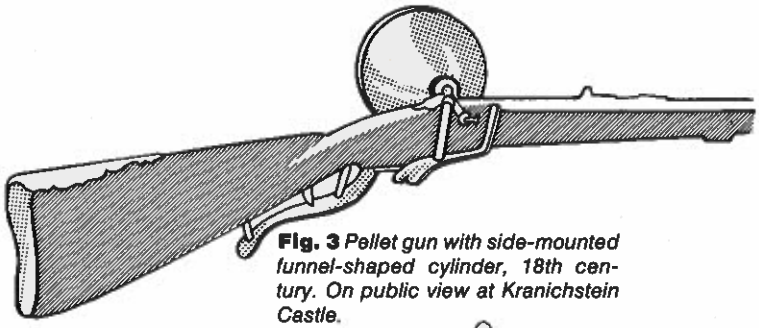


Fig. 3 *Pellet gun with side-mounted funnel-shaped cylinder, 18th century. On public view at Kranichstein Castle.*

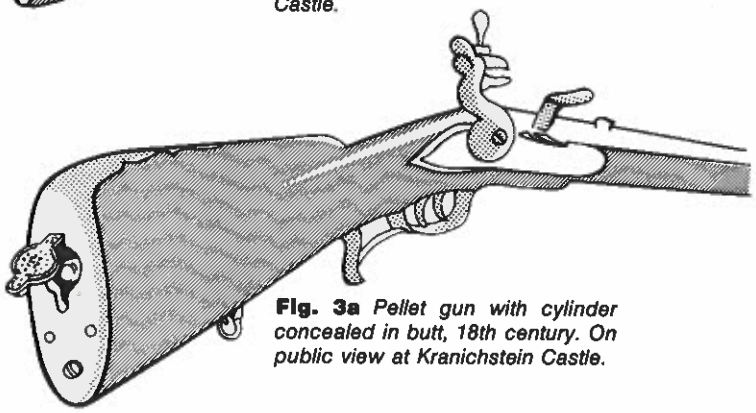


Fig. 3a *Pellet gun with cylinder concealed in butt, 18th century. On public view at Kranichstein Castle.*

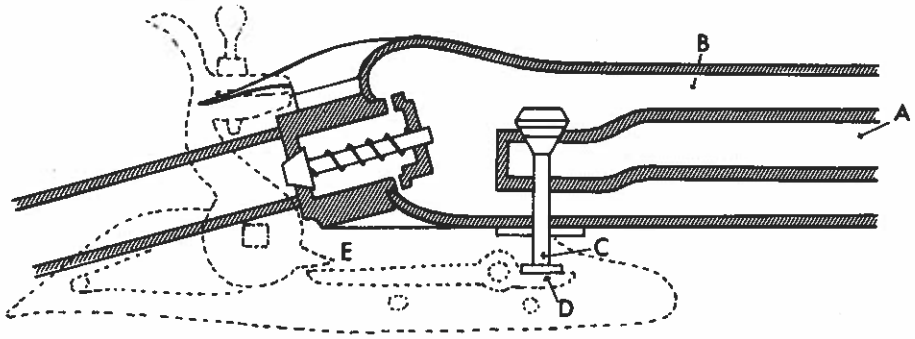


Fig. 4 *Flintlock converted to air rifle. A) Barrel, B) Air chamber, C) Rod valve. When the hammer falls the projection E) trips the lever D) and raises the rod valve C). Air compressed in the chamber B) can escape through barrel A). (after Maleyka)*

claim from 1000 to 2000 strokes. Every gunsmith enclosed instructions for the admissable air pressure. According to old literature, only one man was needed for the initial strokes, as soon as the going got hard, though, a second man had to help with the pumping. To prevent overheating, a pause was made after every 20 or 30 strokes. The barrel was usually of iron, but in lighter weapons sometimes of brass or copper. With the exception of the Austrian Girandoni, to which reference will be made later, air rifles were first and foremost designed for hunting (Figs. 3 and 3a).

It is reported that Ludwig VIII, Count of Hesse (1691–1768) favoured the pellet gun for deer stalking. (Probably the reason for the profuse collection of air guns at Kranichstein Castle.) What these early pellet guns really achieved was demonstrated in 1905 at Neumannswalde. An air gun borrowed from the gun room of Pfaffroda Castle in Saxony was put through its paces. With a 9.5 mm ball the weapon's total range was 500 m, at 33 m it penetrated 3 cm of pine wood. Bearing in mind the value of this museum piece, it was only pumped up 100 strokes. Had the gun been pumped to higher pressures its punch could have slain a stag at 80 m.

In the lighter versions, used for plinking and target shooting, both pump and cylinder were contained in the gun itself. Fig. 4 shows a converted flintlock, whereby the barrel has been encased with an air chamber and the pump fitted in the butt. The pump column is equipped with an eye at its upper end, into which an iron rod is inserted. The marksman then stands with both feet on

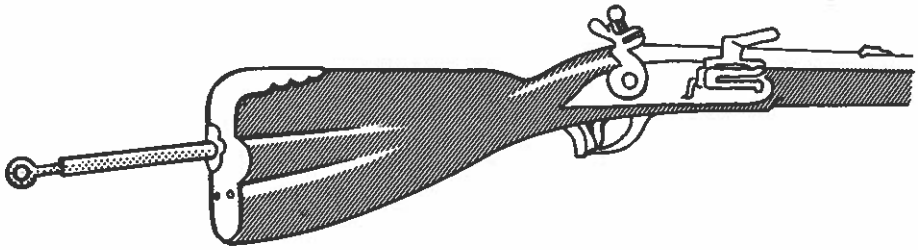


Fig. 5 *Pellet gun with pump in the butt, air is stored in the chamber encircling the barrel. On public view at Kranichstein Castle.*

this rod, and pumps the gun vertically up and down (Fig. 5).

Round about 1800 a pellet gun appeared that had a pair of built-in bellows. When cocking, the bellows drew in air, then when the gun was fired a powerful spring smartly closed the bellows to fire the pellet out of the barrel. The Guericke is mentioned here solely as a curiosity, for its working pressure (under 1 atm.) was so low that the design was never a success.

Fig. 6 *The Austrian military pellet repeater by B. Girandoni. Side and top views.*

At the Dresden museum there is a double-barrelled rifle, one of the barrels for air-propelled pellets, the other for normal powder propelled bullets. There even existed guns combined to shoot pellets or bullets from one and the same barrel. If the marksman wished to fire with compressed air he closed the touch hole with a screw that was attached to the side of the pan. The bottle-like air cylinder was housed in the butt. If he should wish to make use of his powder, he simply re-opened the touch hole and cut off the air supply via a slide or a shutter.

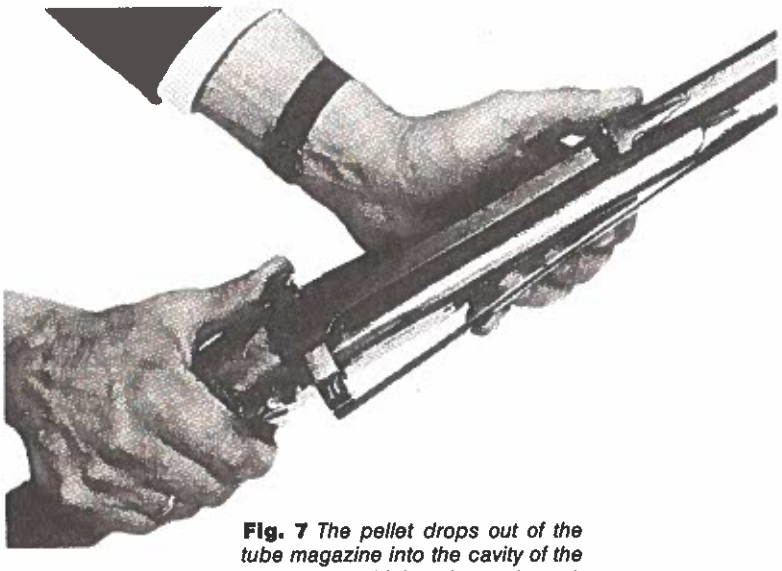


Fig. 7 *The pellet drops out of the tube magazine into the cavity of the slidepiece, which, when released, lies directly behind the breech chamber*

The Austrian Girandoni repeating pellet rifle was used by that country's army for nearly three decades, over a thousand of them being produced. (Fig. 6). The octagonal iron barrel had a calibre of 13 mm, 12 rifling grooves, and a length of 84.4 cm. The tube magazine

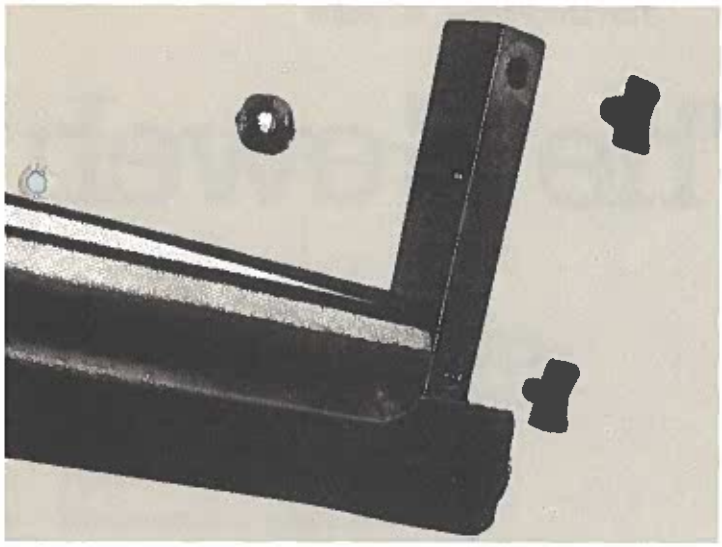


Fig. 8 *Part of magazine and pellet-holder slidepiece.*

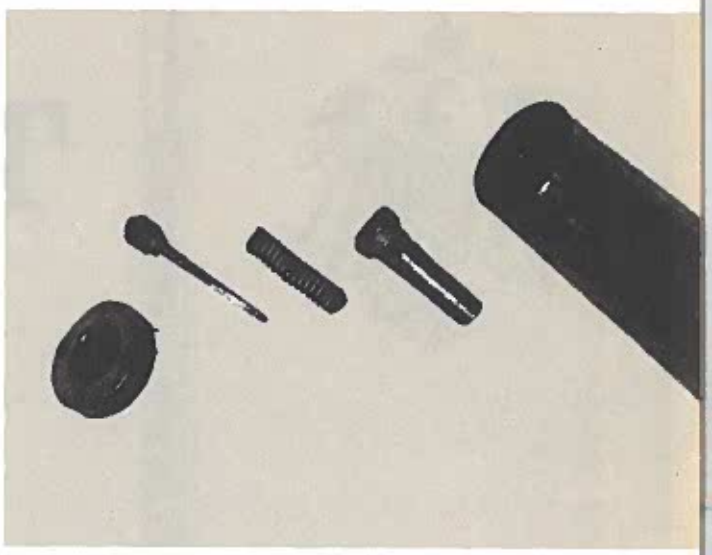


Fig. 9 *Part of the butt cylinder and its relief valve.*

running along the side of the barrel contained 20 pellets. A cross bar, when actuated, seated each pellet separately in the chamber (Figs. 7 and 8). This weapon was so straightforward and ingenious that Field-Marshal Rouvroy recommended the Girandoni to Kaiser Franz-Joseph II on March lst, 1779. The air cylinder, made of metal and covered with leather, was screwed into the gun's receiver in place of the stock, see Fig. 9.

This flask was pumped 2000 strokes to attain workable pressures. The first 10 shots were effective at 120 m, the next 10 at approx. 100 m, and the last 10 at shorter distances.

Each rifleman had three cylinders in reserve, and a waggon full of re-loading equipment and further cylinders followed the "air-gun" troops.

At the beginning of the 1800's these air rifles were replaced with normal rifles. Some historians claim that the Austrians did so because of Napoleon's threat to hang every man found with such a gun; although no direct evidence, written or otherwise, has yet been found.

Technical progress rolled over pellet guns for hunting or for war purposes when the breech loader was introduced in the 19th century. However, air guns still hold a degree of fascination for today's marksmen, and shooting them is internationally recognized as a competitive sport.

I trust this article has aroused the reader's interest in a weapon, which, apart from a few exceptions, is leading a tranquil life in our museums.

For Figs. 6–9 and for his unfaltering assistance, I am greatly indebted to Dr. Walter Hummelberger of the Museums of Vienna. I also owe thanks to Dr. Alexander von Reitzenstein, Director of the Bavarian Army Museum and author of the magazine, "Zeitschrift für historische Waffen- und Kostümkunde."

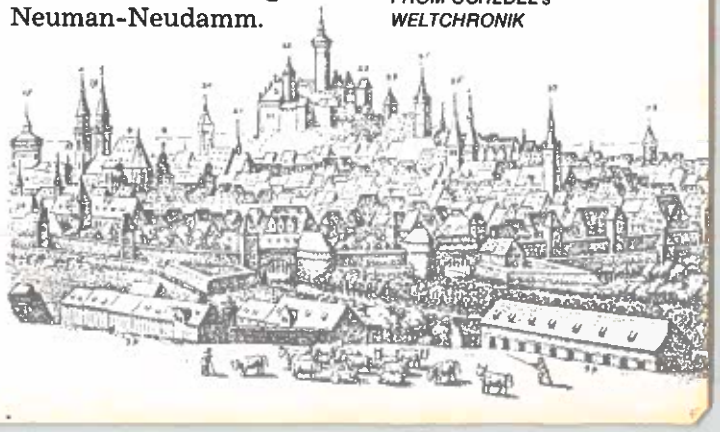
For those of my readers who can understand German I am citing three titles to which they can refer in case of need.

1) Windbüchsen des 17. und 18. Jahrhunderts als Jagd- und Kriegswaffen, Blasrohre. Dr. K. Maleyka. Deutscher Zentralverlag AG, Berlin, 1937.

2) Die österreichische Militär-Repetierwindbüchse und ihr Erfinder B. Girandoni. Dr. Walter Hummelberger und Dr. Leo Scharrer. ZHWK 1964, Band II, und 1965, Band I.

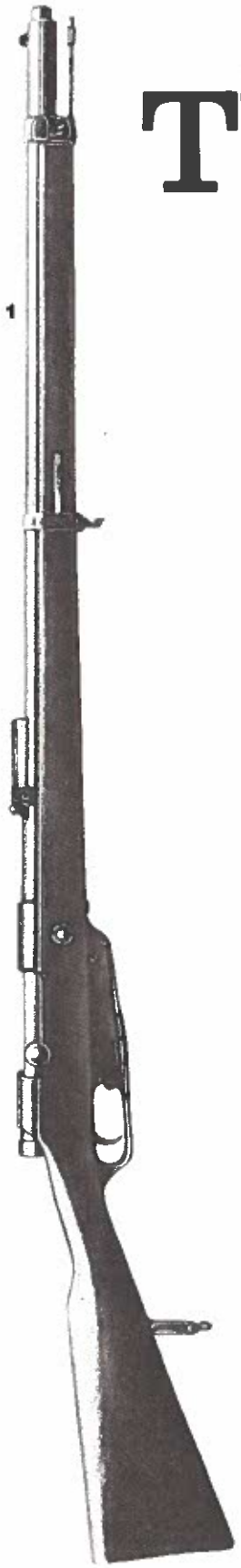
3) Die Windbüchsen im Jagdmuseum Kranichstein. Otto Schäfer, Deutsche Jägerzeitung, 1961, Nr. 20 und 21. Verlag J. Neuman-Neudamm.

WOODCUT OF NUREMBERG, FROM SCHEDEL's WELTCHRONIK



Text and Photos: W. Weller

The Gewehr



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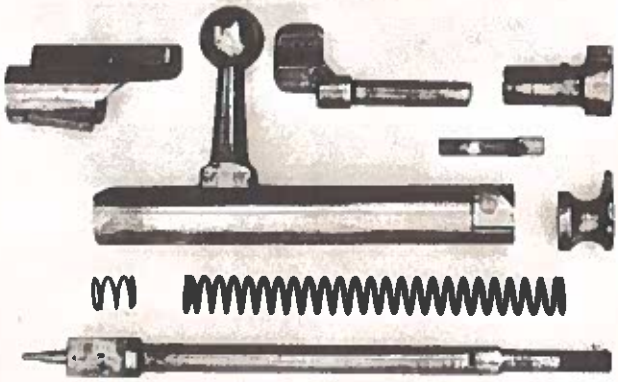

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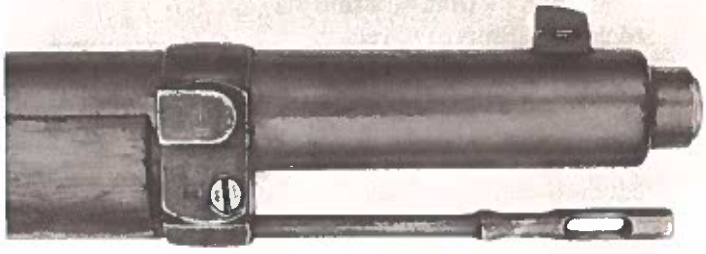

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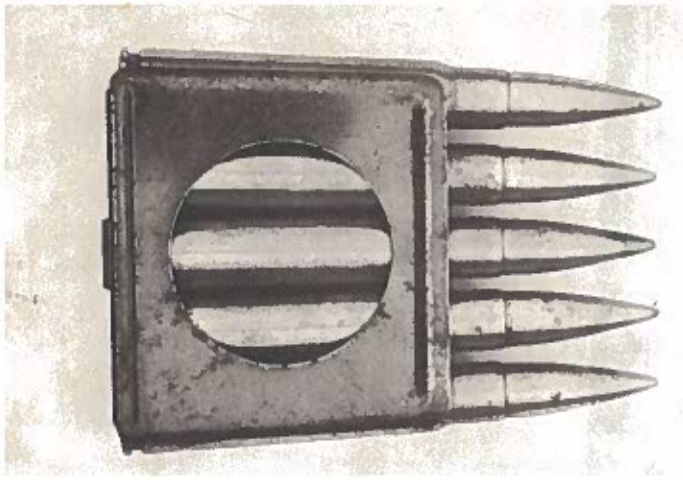
1 *Gewehr 88*
2 *Bolt parts of the G. 88*
3 *Sheet-metal jacket around barrel, bayonet lug, cleaning rod*
4 *Adjustable rear sight*
5 *Clip of 5 S cartridges*
6 *Magazine with blocked exit slot, action open*
7 *Cartridge for original G. 88 (not the "S" version)*

88 and its Variants



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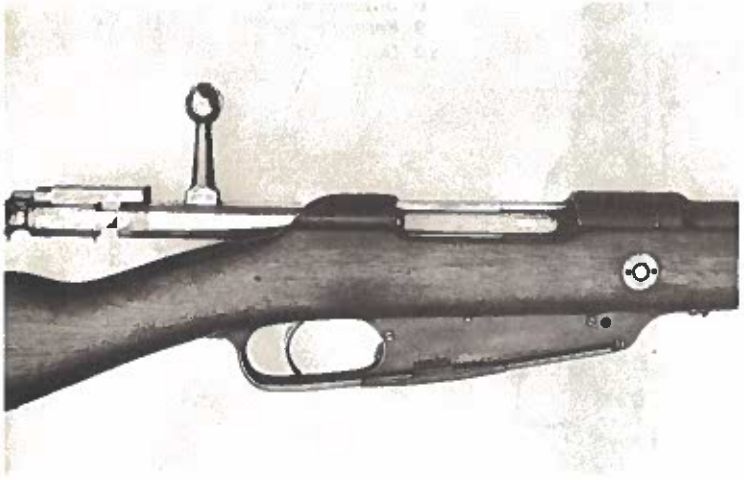

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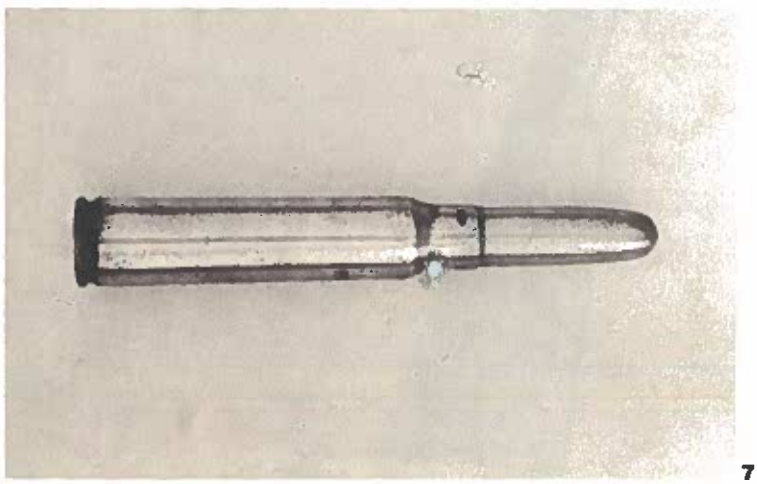

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As ordnance engineering progressed and the calibers of rifles got smaller, a new propellant had to be found to replace black powder which no longer fulfilled practical requirements. When M. Vielle developed a successful smokeless powder in the 1880s, rifle calibres could be reduced even more. But with this powerful new propellant the old lead bullet was too soft to hold together in the barrel rifling, so jackets were developed. Various countries experimented along these lines, but France was the first to solve the problem of stronger bullet design by introducing a solid copper projectile (bale D) for their 1886 Lebel rifle. After Germany followed with a jacketed bullet that functioned perfectly, there was nothing to stop the design of smaller calibres.

The Gewehr 88 which was adopted by the German army is a bolt operated, clip-type magazine rifle. This was a great improvement over the tube-type magazine of the Gewehr 71/84, whereby each cartridge has to be fed into the magazine separately. The Gewehr 88 measured 1250 mm and weighed 3.8 kg, without bayonet. The barrel was 740 mm long and had 4 grooves of 4.5 mm by 0.10 mm in depth. The rifling completed one twist in 240 mm and ran clockwise. The calibre was 7.9 mm (318). The Gewehr 88 was not a Mauser design, it was pieced together from the various systems prevailing at that period. It had, for example, a Mauser-type action, but a Mannlicher magazine.

The bolt is of the automatic cam cocking system, whereby the firing pin is withdrawn in the opening phase (precluding accidental firing when closing the bolt). This system was taken over from Mauser's 71 and 71/84 rifles, but the countersunk breech face and forward locking lugs of the Gewehr 88's bolt were new, and of revolutionary design.

As with the 71 and 71/84 rifles, the trigger mechanism of the Gewehr 88 allowed a certain amount of slack. The safety catch also corresponds to that of the earlier models. The 88's barrel was encased in a sheetmetal jacket to protect the rifleman from burning his hands during rapid fire. The bayonet catch was situated on the right-hand side of the forward band. The rear sight could be adjusted between 250 and 350 m and from 450 to 2050 m. The head of the cleaning rod (under the muzzle) proved an ideal holder when stacking the rifles in pyramids.

The clasp of the lanyard could either be snapped over the stock swivel or, in the short position, clipped into a hole in the magazine casing.

Loading

Open the action and press the clip of 5 cartridges down into the magazine cavity. A holding device keeps the magazine from popping up again. The top cartridge is now in line with the chamber. When you close the bolt this top cartridge is automatically stripped out of its clip and chambered. After firing, pull back the bolt as far as it will go and the empty cartridge case will be extracted and ejected. The follower (a sort of platform) which is anchored at one end to the base of the magazine well, forces the row of cartridges upwards until the second cartridge is in line with the chamber. The loading cycle has been completed. After the last shot the clip is thrown out through the bottom of the magazine well. The disadvantage here, of course, was that in battle all sorts of foreign matter could penetrate the magazine through this exit slot. Later this oversight, a frequent cause of malfunctioning, was remedied by covering this ejection port with a strip of metal upon which a spring plate was attached. Henceforth the empty clip was catapulted out of the top of the receiver.

The cartridge for the Gewehr 88 consisted of a brass hull loaded with 2.6 grammes of smokeless-type powder and an ogival bullet weighing 14.7 grammes. The bullet itself consisted of a lead core jacketed in nickel-plated steel.

8 *Bayonet M 71*
9 *Karabiner 88*
10 *Gewehr 91*

The Gewehr 88 and its Variants

THE VARIANTS

Gewehr 88/S

These rifles were altered to take the slightly heavier S cartridge (323). An "S" was stamped on the receiver head. The sights were correspondingly adjusted for the new trajectory.

88/05

These weapons were also machined for the S cartridge and provided for clip loading, like the Gewehr 98 which appeared later. An "S" was likewise stamped on the housing in 3 mm lettering. A "Z" signified that the rifling was deeper than hitherto.

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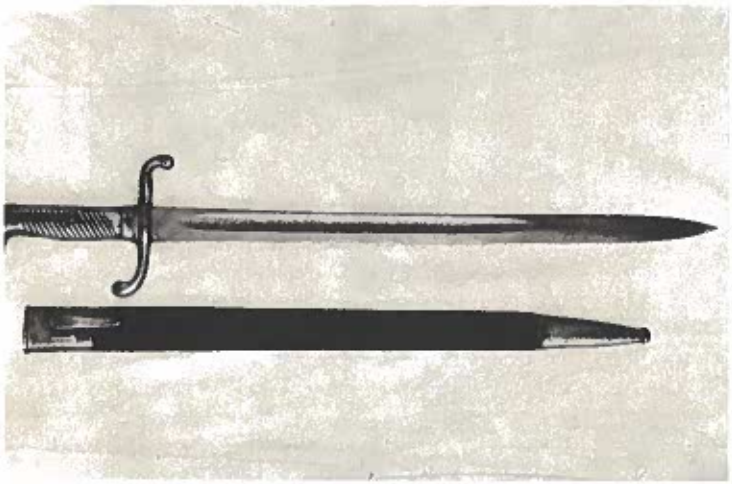

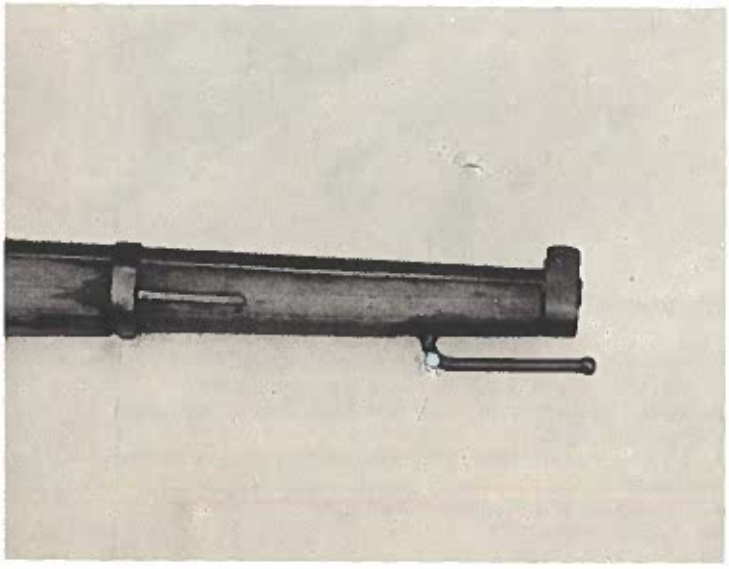

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Similar to the Gewehr 98, the 88/05 received clip guides that were screwed and riveted. The rear part of the left wall of the magazine well was milled out (about 2 cm) for facilitating clip entry. The spring clip holder has been discarded. Its place has been taken by an iron support, as the magazine cavity is too large. The bottom exit was blocked up. Sighting adjusted for the S cartridge.

88/14

Chamber machined for the S cartridge. Stamped with the "S". An "n" signified that the rifling had been re-cut. Rear part of magazine housing was strengthened for clip acceptance by gas welding. Spring clip holder also discarded, and the extra space blocked. Sighting adjusted for the S cartridge. On left wall of magazine a shallowed out thumb index to assist loading. In all the variants of the Gewehr 88 the older type of ammunition could still be used. Of course, allowances had to be made when aiming.

The Karabiner 88

This is a short version of the rifle. Length: 95.5 cm. Barrel length: 43.5 cm. Fore sight shrouded. Bolt handle curved for mounted troops. Lanyard fastened to the left, not under the stock. Rear sight calibrated from 450 to 1200 m. Rear sight smaller than that of rifle. Many of the Karabiner were re-bored for the S cartridge.

Gewehr 91

This weapon resembles the Karabiner 88, but is equipped with a bow under the muzzle to help stack it in pyramids. Although the 91 is classed as a rifle, its measurements put it in the carbine group. Sights and lanyard fitting are the same as those of the K. 88. The 91 was used by the artillery and other troops.

The Gewehr 88 was designed to counter the French Lebel rifle of 1886. In time, however, it was seen that the G. 88 did not quite meet all the requirements of the new era of smokeless powder. Nevertheless, this rifle saw service in Africa with the colonial troops and on all the fronts of WWI. Finally, the Gewehr 88 was replaced by the 98, which was probably the best known Mauser design of all times.

Richard Horlacher · Photos: Hans Kubach

Block-operated Target and Gallery Rifles

These firearms were very popular just after the turn of the century. For over 50 years virtually all matches had been won with block-operated rifles. This success was also ascribed to the very short path of the firing pin, beneficial for a steady let off.

The rifles dealt with here were exceedingly popular between 1885 and 1939. The target versions were fired "standing" at distances ranging from 75 to 300 m, those for gallery use at 15 m. Block-operated weapons are equipped with an action wherein the breechblock slides, revolves or drops, etc. according to its design. Some systems, e. g. the Martini, have what is known as a pivoting block, which, when actuated by the triggerguard lever tilts the front end of the block below the line of the chamber, permitting loading, and cocks the firing pin at the same time. Other systems, e. g. the Aydt, cock the weapon when the block closes.

The walls of the action were color hardened as a rule. These patterns were achieved by wrapping the parts to be tempered in leather and heating them under exclusion of air. However, there were also actions that were plated or engraved.

The main features of the block-operated weapons were the short path of the firing pin, simple functioning, and minimum friction of moving parts. Since the actions were relatively short, the barrels could be longer. Target rifles weighed anything between 3 and 9 kg, usually had octagonal barrels with outside grooves. The more expensive models allowed interchanging of front hooded bead, partridge or special target sights adjustable for windage. The rear part of the barrel was often grooved to accept open sights, and on the tang there were provisions for aperture sights; the iris of which could sometimes be increased or decreased in size for various light conditions. The hair trigger could be adjusted to vary the

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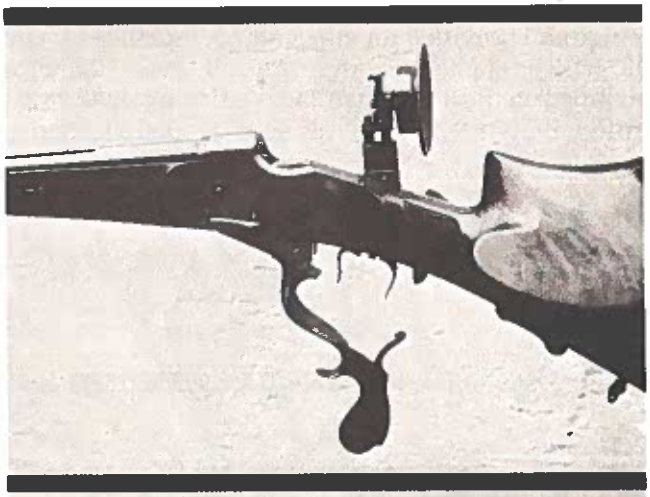

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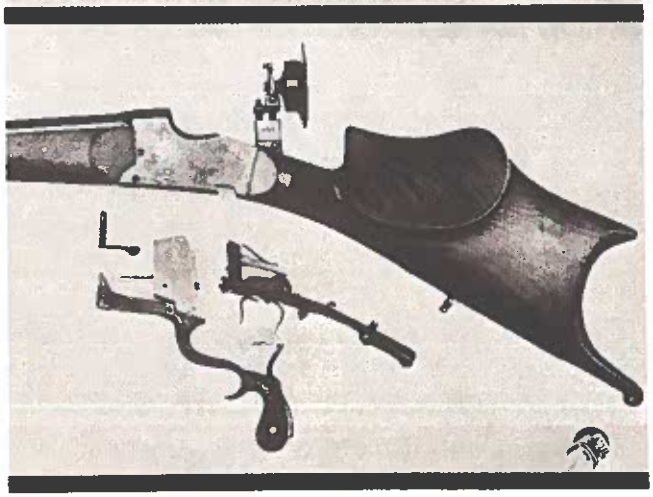

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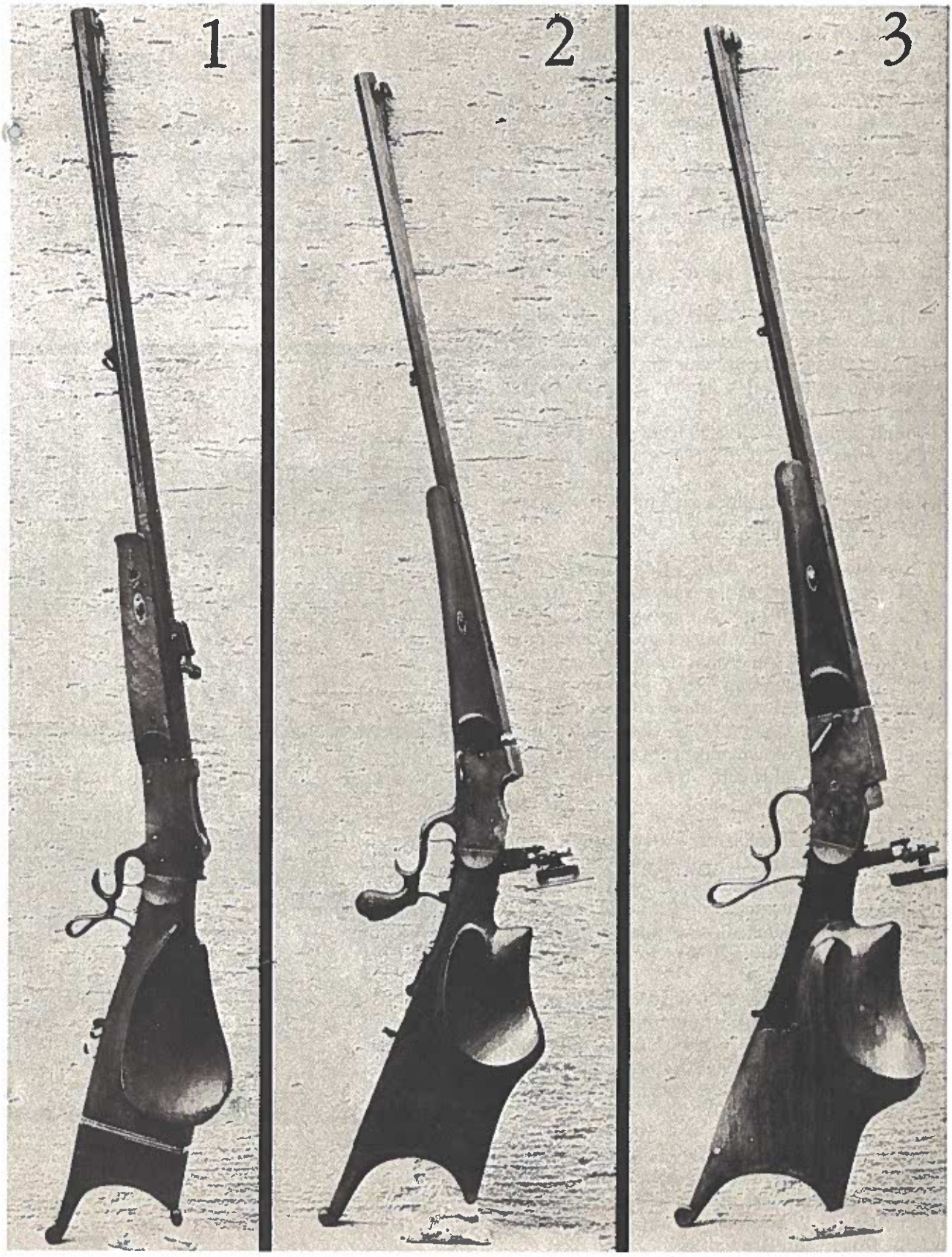
1 *Swiss target rifle with Martini falling block; grooved barrel; adjustable rear sight; Swiss buttstock; adjustable hook buttplate.*
2 *Büchel "Meisterbüchse" with falling block; Tyrol buttstock; adjustable aperture sight.*
3 *"Original Haenel" gallery rifle with swinging block; interchangeable barrel.*
4 *Grooved barrel with ajustable front sight.*
5a *Büchel "falling block".*
5b *The above rifle stripped*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weight of pull. The trigger guard was curved to fit the fingers. Stocks were either Tyrol or Swiss with large cheekpiece, thumbrest and hook buttplate.

The rifles of 1880 were chiefly chambered for cal. 9.5x47 R. This was reduced between 1890–1900 to cal. 8.15x46 R, which, alongside cal. .22 L.R., remained popular till the end of the last war. These days cal. 8.15x46 R is a rarity.

The block-operated target and gallery rifles looked very much the same externally. The differences being:

1) The gallery rifles were lighter, weighing between 3½ and 4½ kg.
2) The gallery rifles fired 4 mm rimfire cartridges.
3) Some barrels could be loaded in the normal fashion, others (such as the Stiegele and the Neumann) required a so-called quick loader, since the barrels had a special mounting. The 4 mm rimfire cartridge shot round balls, sorted in size from No. 1 (4 mm) to No. 21 (5 mm). Nos. 7 to 12 (4.3–4.8 mm) were the most used.

Rifles operating with block systems can be divided into three main groups.

1) Pivoting block: With this system the breechblock is hinged at the rear end. The front of the block tips down into the receiver to expose the firing chamber when the trigger guard lever is actuated. This block is sometimes fitted with a hole or a groove to permit a cleaning rod to pass down the barrel from the rear. However, some models are so designed that the block assembly can be removed without tools. The best known makes are Martini, Frankotte, Kessler, Weihrauch, BSA, Stahl, Zeller, Richenbach and Werder.

2) Falling block: here a very strong and stubby block slides vertically in mortises in the receiver wall. With this design the block in no way obstructs the passage of the cleaning rod from the rear. Popular makes were Büchsel, Farquharson, Haenel, Langenhan and Weihrauch, Winchester, Stevens.

3) Swinging block: this system, whereby the block is pivoted below the line of the chamber, is as easy to clean as the falling block. When thinking of German arms Kolbe, Tanner, Büchel, Reform and Original Aydt (patented Feb. 16, 1884) are the names that spring to mind.

All these rifles are much coveted by gun buffs and collectors today. For in Germany only one firm now produces a modern version of these block-operated target rifles, viz. Weihrauch, in England BSA, and in the USA Ruger and Browning.

Block-operated Target and Gallery Rifles

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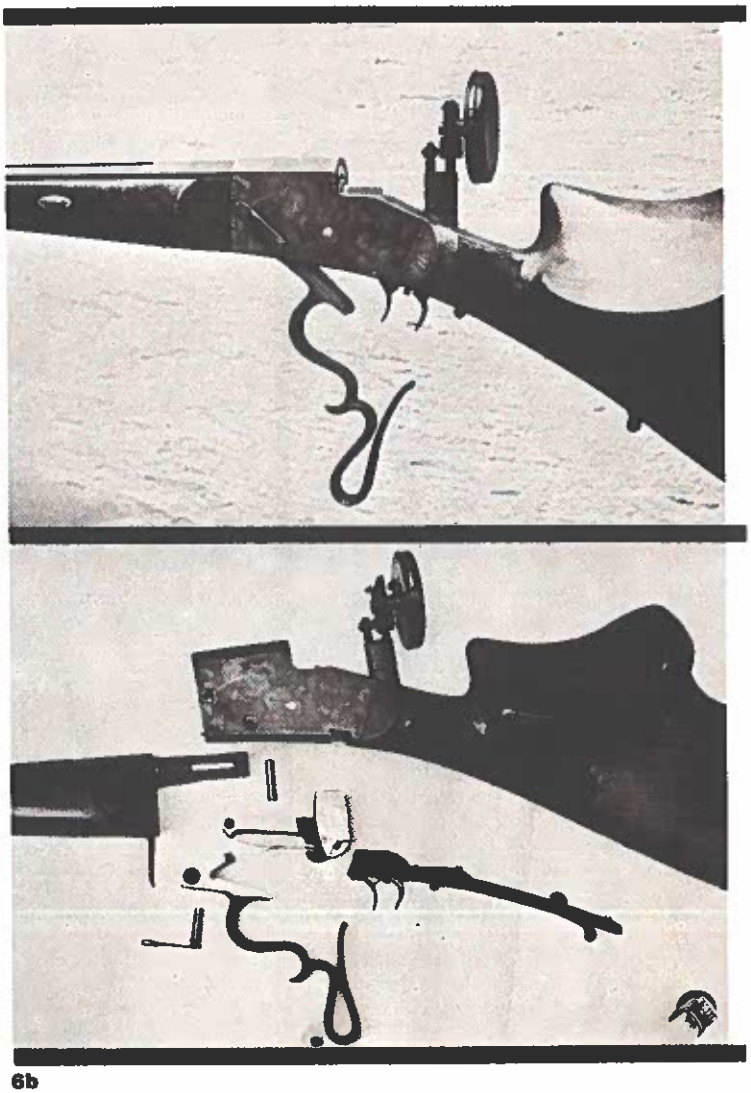

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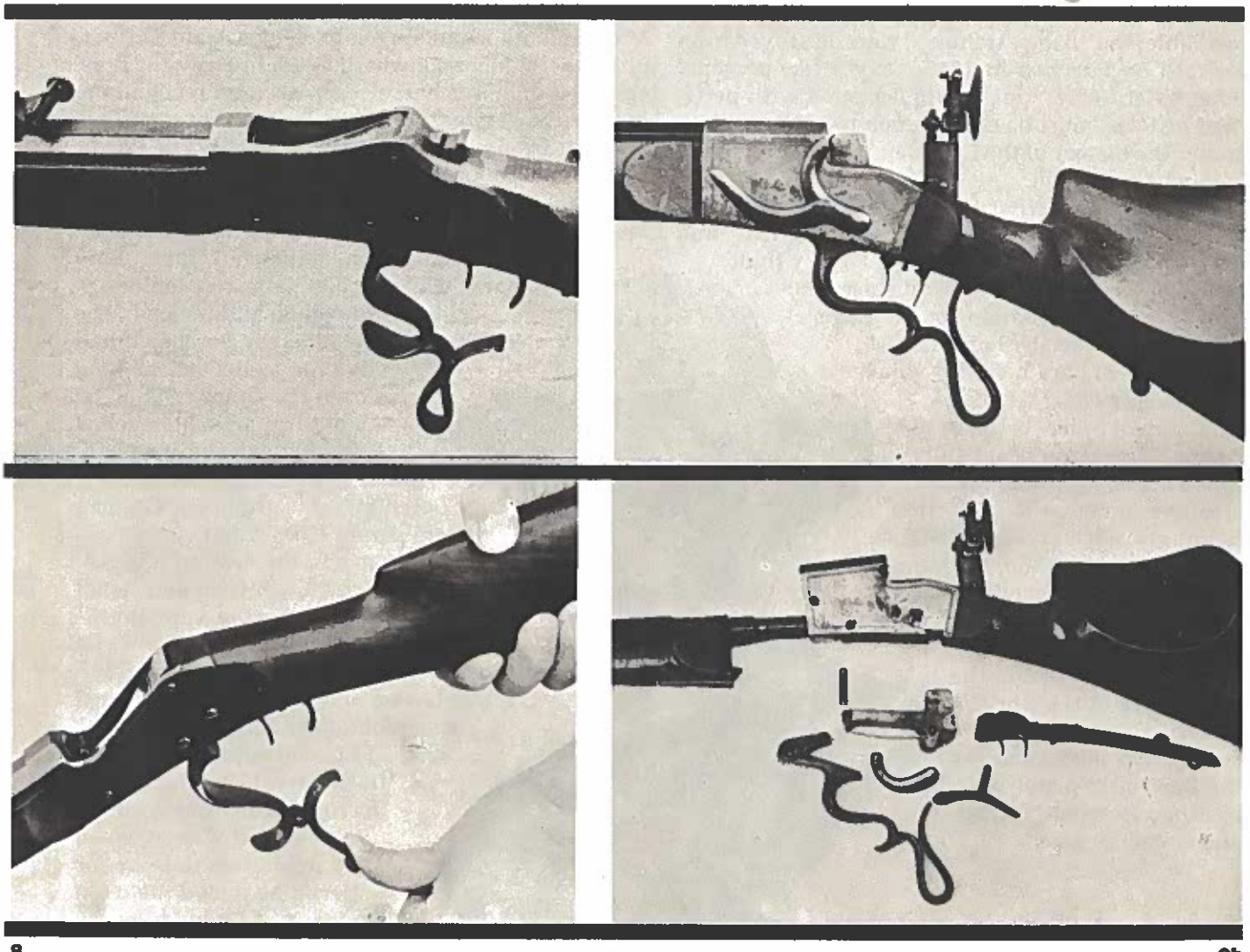

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6a *The Aydt-Haenel with swinging block partially open. The top of the exactor can be seen.*
6b *Field stripped. Note take-down barrel.*
7 *Martini pivoting block, open.*
8 *Martini pivoting block with double-clawed extractor.*
9a *Original Aydt, swinging block with external extractor.*
9b *The Aydt field stripped.*

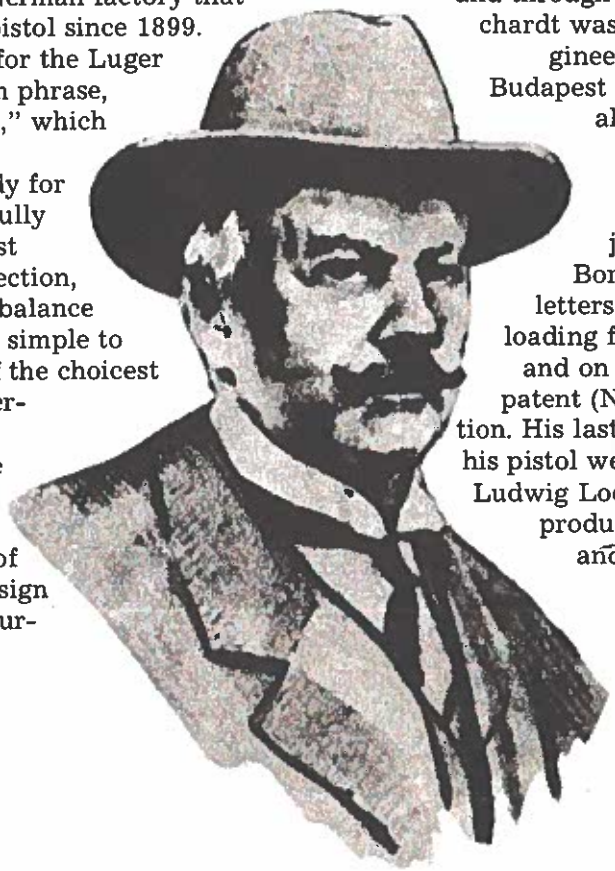
The Lugers

Approximately 3 million Lugers were manufactured in Germany, Switzerland and England between 1899–1942. For many years they were considered to be the best pistols in the world. But nobody really knows why these pistols suddenly became so popular! Now that the Luger has been discontinued, our only sources for information on gun and popularity are the various books on the subject. Official German sources, such as the reports of the "Royal Prussian Gun-Testing Commission", are no longer available; the "Army Archives" were destroyed in an air raid on Potsdam in 1945. Only a few personal notes exist today, which, supplemented with pertinent articles, must be drawn upon to help piece together the history of the Luger and the history of the men who created it.

The designation "Parabellum" came from the telgraphic address of the "Deutsche Waffen- und Munitionsfabriken," the German factory that had been producing this pistol since 1899. This German appellation for the Luger is a derivative of the Latin phrase, "si vis pacem para bellum," which in English means, "if you would have peace, be ready for war." "Lugers are beautifully constructed, accurate, most effective, function to perfection, fit snugly, have excellent balance and hang in the hand, are simple to operate and were made of the choicest materials. Hence their overwhelming popularity and commercial success in the gun circles of the world." In actual fact, the Luger is a further development of the Borchardt pistol, a design by Hugo Borchardt, a naturalized American.

Georg Luger was born in Steinach (Tyrol) in 1849, and was an officer in the Austrian army. He had a marked predilection for small arms and was on very friendly terms with the world-famous gun designer Ferdinand von Mannlicher, with whom he experimented on selfloading weapons. However, when Luger left the army he was offered a position as senior engineer in the armaments factory of Ludwig Loewe und Co., in Berlin. This leading German gun factory, which in 1887 had bought up all the shares of Mauser, authorized Luger to demonstrate Mauser products in America, where he eventually met Borchardt. Borchardt had already secured recognition in the field of gun technology, but had not managed to profit from his patents, which probably accounts for his erratic job-changing.

Ludwig Loewe and Co. also possessed the share-majority of a Hungarian gun factory in Budapest; and through the mediations of Luger, Borchardt was offered the post as senior engineer and technical director in the Budapest plant. Whether Borchardt had already produced a self-loading pistol in the United States, or not until after he reached Budapest, is subject to conjecture. On September 9, 1893, Borchardt was granted a German letters patent (No. 77,837) for a self-loading firearm in the form of a pistol; and on March 18, 1894, an additional patent (No. 77,748) for the same invention. His last letters patent (No. 91,998) for his pistol were issued on October 10, 1896. Ludwig Loewe and Co., of Berlin, started production of the Borchardt in 1893 and sold to the public until 1896. In Budapest, Borchardt was having difficulties with the Secretary of War so, when Luger urged him to leave for Berlin he joined the main company of Ludwig Loewe.



Georg Luger

This handgun is famous throughout the world, be it known as the "08," the "Parabellum," or the "Luger." As a collector's item the Luger is well worth while, for prices are steadily climbing. The author of this report, Otto Marawietz, is no theorist, all his knowledge on the subject comes from years of practical experience.

1) *Top: the Borchardt*
Left: the Borchardt-Luger
Centre: Long-barrelled Luger (Navy)
Bottom: Swiss Luger

The Borchardt Pistol

The self-loading Borchardt, or carbine pistol, has a toggle joint locking action. As the bullet leaves the barrel, barrel, breechblock and attached toggle assembly fly backwards in unison until the knobs of the toggle ride up the slope of the rear part of the frame, whereby the breechblock then separates from the chamber of the barrel when the toggle bends up like a human knee, although the barrel is still travelling on its backward journey. An extractor embedded in the head of the breechblock retracts the empty cartridge case far enough to be hurled out of the ejection port by the ejector. The expanding gas pressure of the spent cartridge case has dropped to an insignificant level when the return movement of the breechblock/toggle assembly sets in under spring pressure: stripping the top cartridge off the magazine and guiding it into the chamber. When the sections of the toggle assembly lie in an axis slightly under a straight line, the breechblock is securely locked with the entire barrel unit. The idea behind this locking system is to prevent the breechblock from opening before dangerous gas pressure has dropped to safe limits.

On the return movement of the breechblock, a sear engages with the striker, which is housed in the breechblock, and retains it in a cocked position. Pulling the trigger actuates the trigger bar, releases the striker and ignites the cartridge. The bottle-shaped Borchardt cartridge, the forerunner of the well-known Mauser 7.63 and very similar to the Mannlicher 7.63, will not interchange with other calibers.

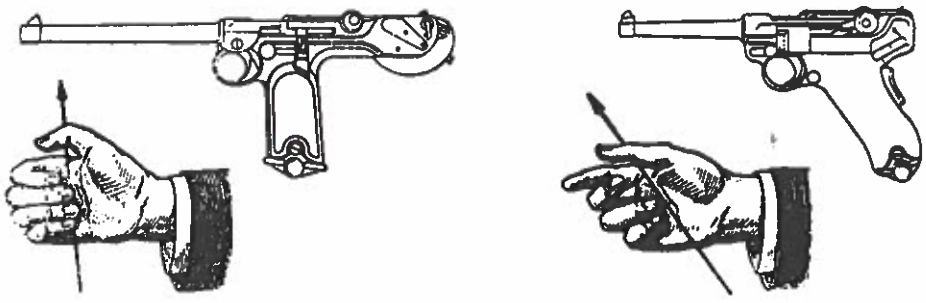
Between 1893 and 1896 the Borchardt was protected by letters patent in all important countries, and sold in all world markets from 1893 onwards. The price of about 126 Reich marks included a wooden shoulder stock with removable cheekpiece, a strap, 3 reserve magazines and a dummy magazine containing screwdrivers, cleaning rod and a bottle of oil. For an extra 20 marks a fitted leather case was available. Very few complete sets are in existence today, most of them being in foreign collections. One may be sure that the Prussian Gun-Testing Commission subjected the Borchardt to a thorough examination, but we do not know whether troop trials were conducted with it. On November 22, 1894, the Boston Herald wrote an extremely interesting report on the Borchardt pistol which had been presented to the US Navy Commission the day before at Rhode Island by Luger. A pistol for which the Americans prophesized a great future. It must be interesting to the reader that G. Luger carried out the demonstrations in America, not Hugo Borchardt. The ammunition was designated: Luger, Cal. 7.65 rimless.

The American army also took interest in the new pistol. On November 28, 1894, an Army Commission was sent to Springfield to put the Borchardt carbine through its paces and to publish a report. Both navy and army trials were discontinued after a time, so one must assume that the Borchardt was found unacceptable.

The Borchardt functioned well under unfavourable conditions, but was less suitable as a pistol owing to its ogre-like dimensions.

In 1899 Ludwig Loewe und Co. bought out the Deutsche Metallwarenfabrik Lorenz. Articles of incorporation were drawn up between the Loewe Powder Factory, Rottweil/Hamburg, and the Vereinigte Rheinisch-Westfalische Powder Factory to found a new firm, the Metallwarenfabrik (metal factory) in Karlsruhe. On November 4, 1896, the members of the corporate meeting decided to change the firm's name to Deutsche Waffen- und Munitionsfabriken (DWM), and to transfer the headquarters to Berlin. On December 10, 1896, L. Loewe and DWM bought out the gun factory at Martinikenfelde (today Berlin-Moabit), and Loewe's Mauser shares went to DWM.

Borchardt and Luger were good friends, also the

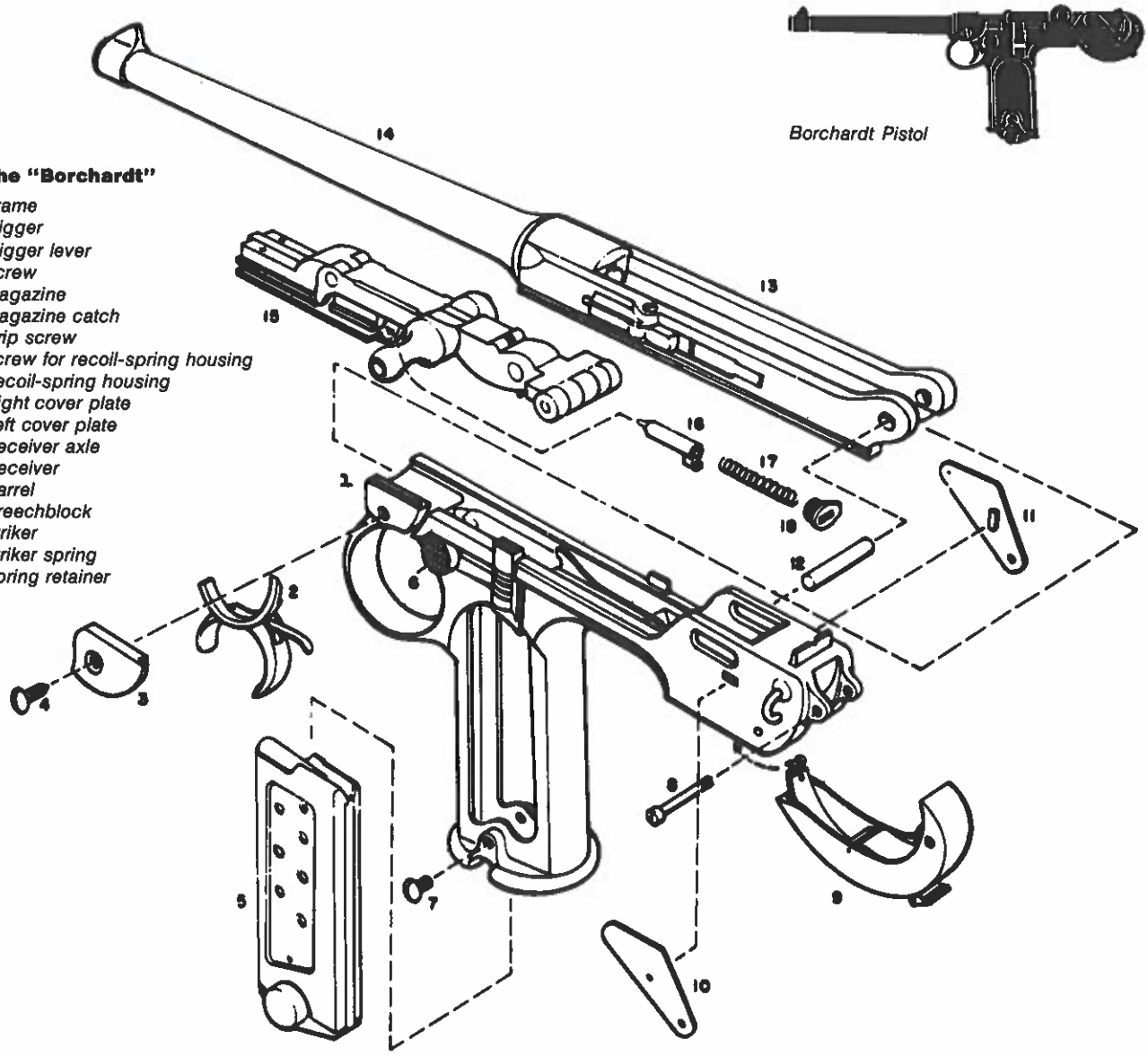


2) *The difference in the angle of the handle of the two pistols.*

Borchardt Pistol

3) The "Borchardt"

1 *Frame*
2 *Trigger*
3 *Trigger lever*
4 *Screw*
5 *Magazine*
6 *Magazine catch*
7 *Grip screw*
8 *Screw for recoil-spring housing*
9 *Recoil-spring housing*
10 *Right cover plate*
11 *Left cover plate*
12 *Receiver axle*
13 *Receiver*
14 *Barrel*
15 *Breechblock*
16 *Striker*
17 *Striker spring*
18 *Spring retainer*



members of their respective families met socially. However, during working hours the two gun designers did have their differences; for Borchardt was so convinced of the excellence of this brainchild that it is alleged he refused to tolerate any changes in design. Practically vertical in angle, the grip of the Borchardt was uncomfortable to hold when shooting. At the rear of the pistol was a bulbous housing for the return spring, a definite handicap for a weapon designed as a handgun. Nevertheless, the performance of the new self-loader was irreproachable, and even endurance tests under appalling conditions proved the merits of a locked-action, blowback toggle assembly mechanism.

Since Borchardt refused to "modernize" his invention, it fell to Luger to undertake the necessary steps. The toggle system was retained; therefore some parts of the action of the Borchardt could be used for the new design without change. Other parts were slightly re-designed. The barrel became snubbier but retained its slim lines, the grip was set at an angle to give the weapon better hang and balance, the recoil spring was placed in the handle behind the magazine (an S-spring in the original model), the extractor remained unchanged but the ejector appeared on the right of the inside barrel extension, all screws disappeared, apart from the two holding the grip plates, for the parts of the pistol that became famous as the

"Luger" were "jigsaw-puzzle" fitted with pins. The successor to the Borchardt had taken on what we might call today a "handgun" appearance. No longer was there any need for a container full of screwdrivers, cleaning rods or bottles of oil.

The Borchardt-Luger-Parabellum 1900

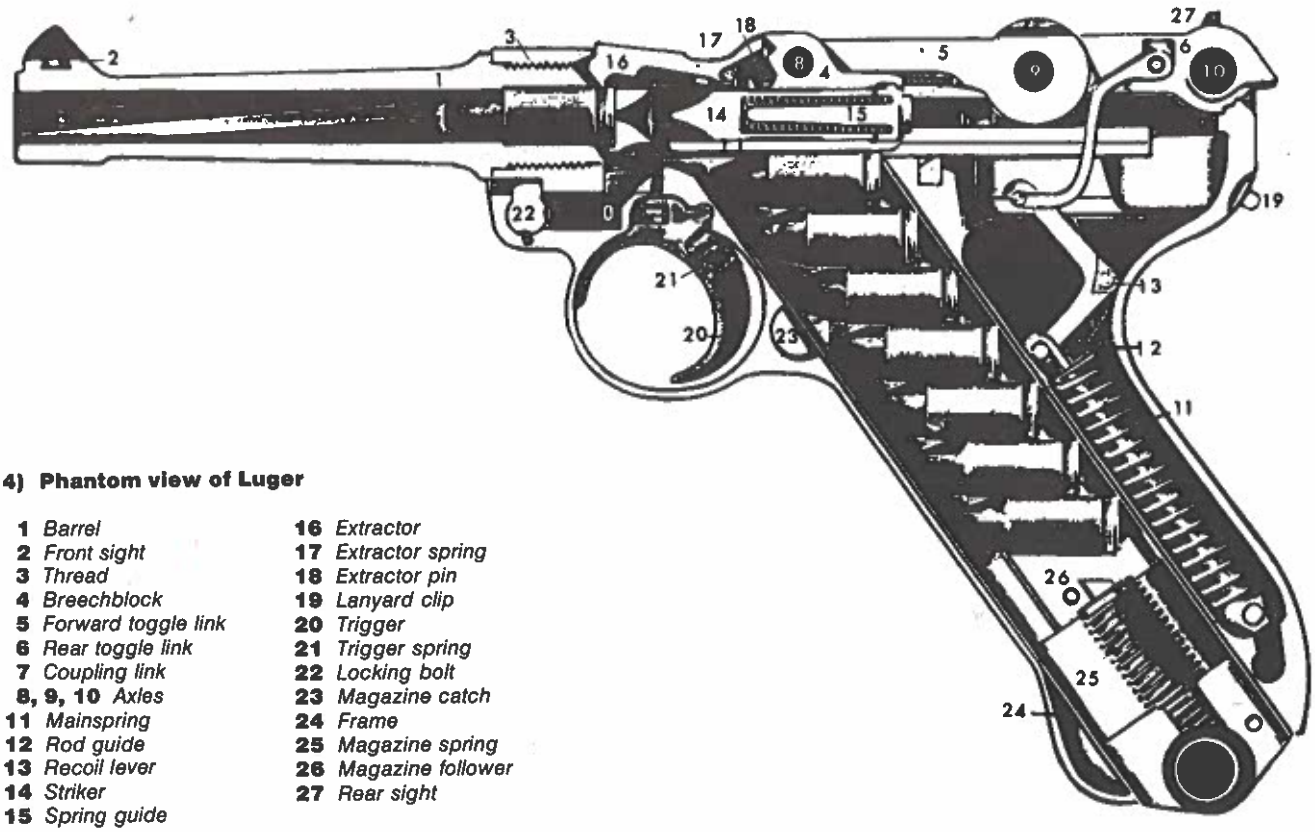
The Borchardt-Luger, as the pistol was now called, displayed a grip safety, which was patented (No. 109.481) on September 30, 1898, at the German patent office. The weapon could only be fired when a protrusion in the backstrap was depressed by the palm of the hand, a sort of second trigger. In other words it was impossible to fire the gun without holding the grip very firmly. Once one's hold on the pistol was loosened the trigger mechanism automatically blocked. However, a small lever could be actuated to disconnect the grip safety when required. Otherwise, the actual firing operation of the new handgun was identical with that of the original Borchardt.

In 1899 the Borchardt-Luger went into production at DWM's plant in Berlin as the "Parabellum". However, this appellation did not catch on in America. DWM's agent in America, Hans Tauschner, christened the pistol "Luger" – today a household word in all the English-speaking countries. The newspaper reports on the testing of the Borchardt pistol in the States a few years earlier had already put Luger's name in the limelight, hence the hearty response to his new pistol.

The Army Ordnance Departments of the countries that adopted the Luger used various systems of designation. The Swiss army, the first ever to adopt the Luger, called it the M 1900, M 1906 and M 1926; the Germans decided on "Pistole 08," and the Portuguese settled for 943. The usual procedure is to employ the date of the year of adoption.

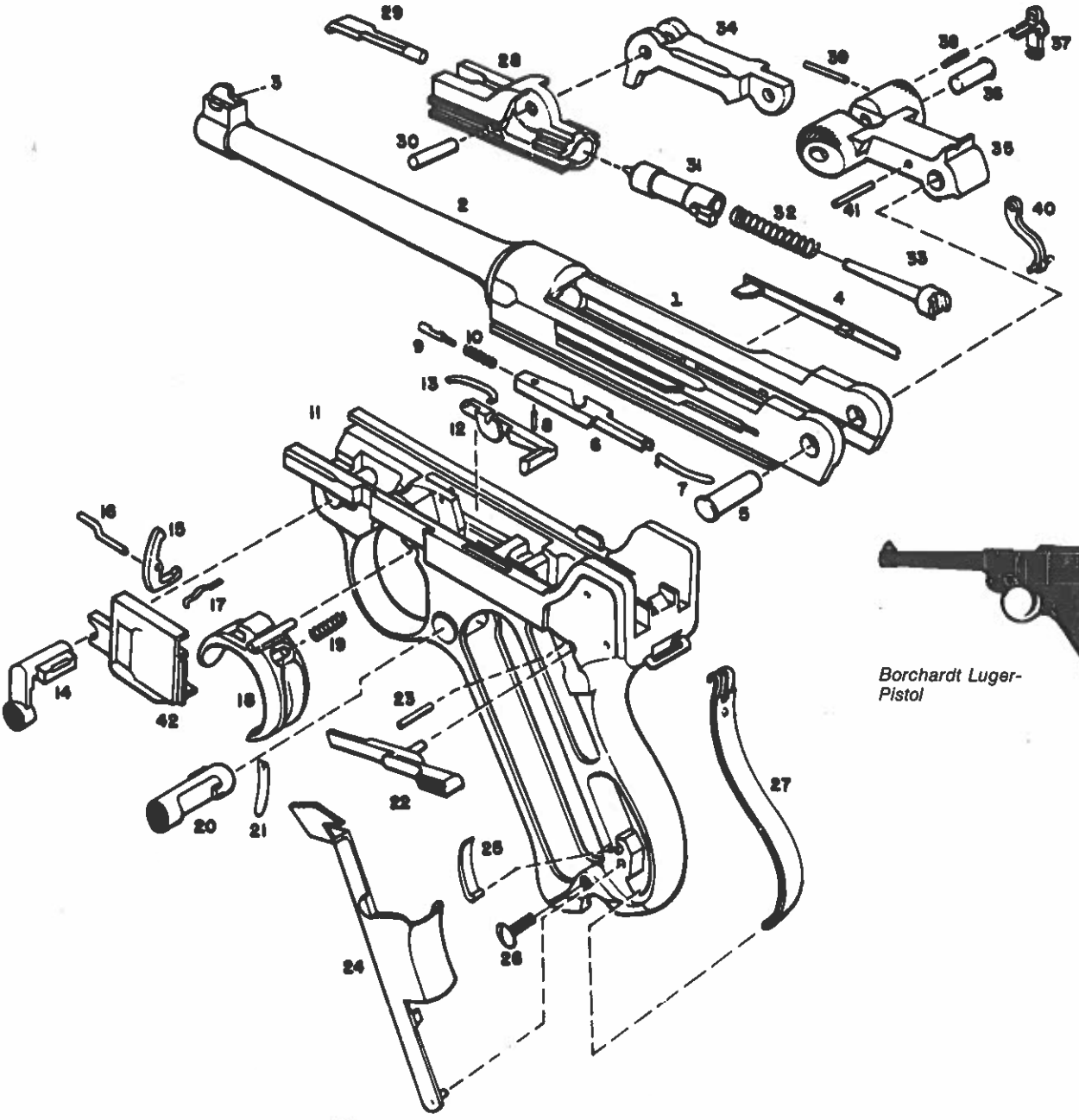
The Swiss had heen looking around for a new military pistol, and between November 24 and December 8, 1898, tests were conducted in Berne with the Borchardt-Luger, Mauser, Bergmann, Roth and Mannlicher. The Borchardt-Luger was the sole contestant to survive the endurance tests, not even dust and water trials could daunt its firepower.

Additional tests took place between May 1 and 3, 1899, this time with two more competitors, the Hauff and Browning pistols. Since the Borchardt-Luger won the competition with flying colors, the Swiss Bundesrat decided to adopt this pistol on April 2,



4) Phantom view of Luger

1 *Barrel*
2 *Front sight*
3 *Thread*
4 *Breechblock*
5 *Forward toggle link*
6 *Rear toggle link*
7 *Coupling link*
8, 9, 10 *Axles*
11 *Mainspring*
12 *Rod guide*
13 *Recoil lever*
14 *Striker*
15 *Spring guide*
16 *Extractor*
17 *Extractor spring*
18 *Extractor pin*
19 *Lanyard clip*
20 *Trigger*
21 *Trigger spring*
22 *Locking bolt*
23 *Magazine catch*
24 *Frame*
25 *Magazine spring*
26 *Magazine follower*
27 *Rear sight*



Borchardt Luger-Pistol

5) Exploded view of the Luger-Borchardt 1900–1902

1 *Barrel extension*
2 *Barrel*
3 *Front sight*
4 *Ejector*
5 *Receiver axle*
6 *Trigger bar*
7 *Trigger bar spring*
8 *Pin*
9 *Disconnector*
10 *Spring for above*
11 *Frame*
12 *Hold-open latch*
13 *Spring for above*
14 *Locking bolt*
15 *Trigger lever*
16 *Lever pin*
17 *Spring*
18 *Trigger*
19 *Trigger spring*
20 *Magazine catch*
21 *Spring for above*
22 *Safety catch*
23 *Safety catch pin*
24 *Grip safety*
25 *Spring for above*
26 *Grip screws (2)*
27 *Mainspring*
28 *Breechblock*
29 *Extractor*
30 *Breechblock axle*
31 *Striker*
32 *Striker spring*
33 *Spring guide*
34 *Forward toggle link*
35 *Rear toggle link*
36 *Center toggle axle*
37 *Axle retainer*
38 *Spring for above*
39 *Toggle pin*
40 *Coupling link*
41 *Cover plate*

(Grips and magazine not shown)
Illustration: Gun Digest 1964

1901, and presented DWM with a contract for 3000 Parabellums; which the Swiss Ordnance Department re-named "Modell 1900." This order was an excellent starter for the Berlin factory, and the guns sold to the Swiss were the first ever to bear the DWM markings.

On April 16, 1901, the commanding officer of the Springfield arsenal was instructed to purchase 1000 Lugers for troop trials. Holsters and accessories, however, were produced at the Rock-Island Arsenal, and the pistols themselves were stamped with American proof marks as well as the American insignia. As far as we know, these handguns were unofficially proved, and it was DWM who stamped the later shipments! Some people naturally think that Lugers bearing these markings must stem from US military production; but this is not so.

Borchardt and Luger took every precaution to patent each step in the design of their pistols. Apart from German letters patent, a patent was granted in England (No. 4399) on March 7, 1900, and in America (No. 75 414) on March 1, 1904. The American patent specifications covered 7 1/2 pages, drawings and diagrams another 10.

Austria, Spain, Canada, Russia, Brazil, Holland, Bulgaria, Norway, Portugal, Chile and other countries took an interest in the Luger, making it a financial success for its designers and those concerned with the manufacturing side of the enterprise.

The German army issued the Luger for the first time, on a trial basis, to its officers in the Chinese Boxer Rebellion of 1901. In the following years, till 1908, extensive tests and troop trials were conducted with all sorts of self-loading pistols, whereby the Mauser C 96 played an important part. Ammunition underwent further development, and in 1902 DWM introduced a new Luger chambered for a 9 mm cartridge. Model 1902 had a 100 mm barrel, a grip safety like the one in the 1900 model, and a narrow window in the grip plate for counting the cartridges. Not many of this cartridge-counter model were produced, although the 9 mm calibre did arouse interest. Today, more than 50 years later, this is still the most widely used military pistol cartridge in the world. This cartridge has a cannelure around its base, not the protruding rim of the revolver cartridge. The hard lead bullet was encased in a nickel-plated steel jacket, originally with a flattened head.

The German navy was the first to recognize the Luger's value, and adopted it in 1904. The so-called navy model had a 150 mm barrel with a two-step rear sight mounted on the rear section of the toggle. Otherwise this navy model was identical with the DWM 1902, apart from not having the cartridge counter.

In collector circles the Luger carbine is very much in demand, a model that appeared in 1904 to compete with similar weapons, viz. Mannlicher, Mauser, Bergmann and Browning. With barrels ranging from 200 to 400 mm, these Lugers could not be classed as pistols; nor as rifles, as the cartridge was too weak. In performance they were somewhere between a pistol and a proper carbine, and were also intended for hunting.

The pistol itself was none other than the 1900 model with extended barrel and rear sight adjustable from 100–300 m. The barrel rested in a wooden forearm, and the shoulder stock clipped into special grooves in the backstrap. To increase muzzle velocity, a beefed-up cartridge was developed with more powder than the standard 7.65 mm Luger cartridge. This high-speed ammunition had black cases, and was not to be fired from normal pistols.

When President Theodore Roosevelt visited Germany before WWI, Emperor Wilhelm II invited him to partake in a hunt and he then presented his guest with a Luger carbine, which can be seen displayed in the Roosevelt House, New York.

Luger 1906 (new type)

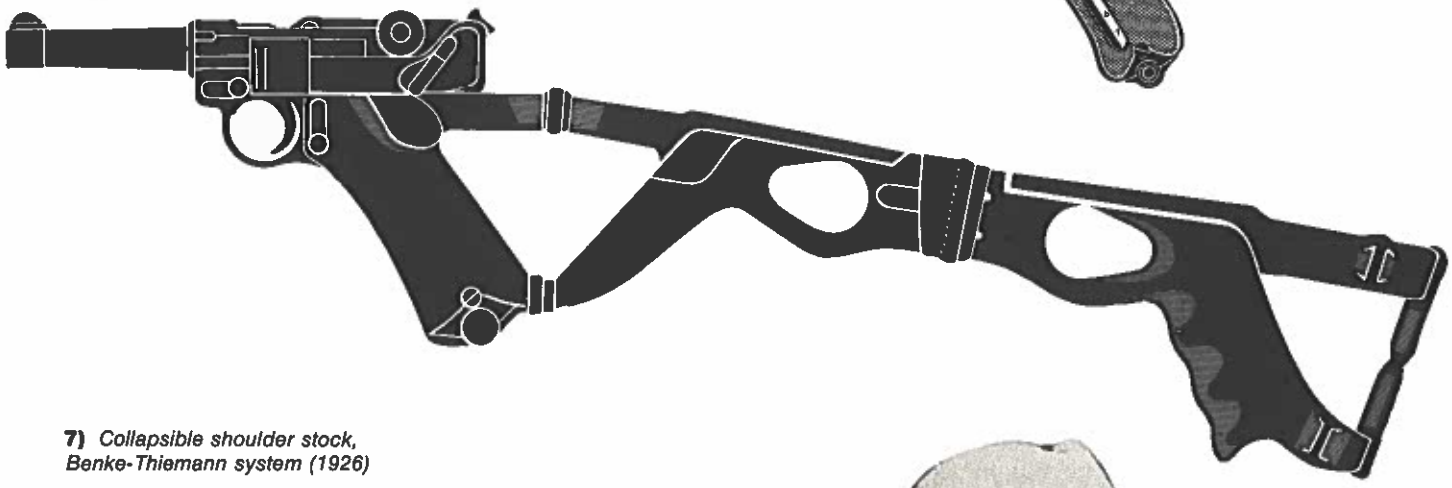
DWM tried continually to improve the Luger. In 1906 the flat S-type mainspring was replaced with a coil spring, hence "new model." All Lugers manufactured after 1906 are coil-spring operated.

The development of the Luger was followed closely by military experts everywhere, and in the spring of 1907 the American army decided to subject it to a further series of tests, prior to adopting an automatic pistol for their armed forces. The US sent DWM 5000 rounds of .45 pistol ammunition, and requested them to have the Luger rechambered. DWM rejected the American rounds, claiming that they were not consistent. A new Luger cartridge emerged, the 445 Luger. DWM used 11 mm Bergmann cartridge cases, loaded them with DWM powder, and crowned this combination with the original American bullets.

These .45 Lugers were a cross between the 1902 and 1906 models, with slight alterations. Very few were produced.

They bore no official proof marks and must be regarded as non-saleable experimentation models. However, they were stamped with the initials "GL", and Georg Luger conducted the tests in America himself. Nevertheless, the Americans decided to adopt their own Colt .45 in 1911.

6) *Luger 1902 with cartridge counter*



7) *Collapsible shoulder stock, Benke-Thiemann system (1926)*

8) *Artillery model 1908 with 32-shot drum magazine*

Further developments in self-loading pistols ousted the trusty revolver in many armies, including Germany's. The Germans officially adopted the Luger in 1908, and called it the Pi. 08. In 1909 the Luger was issued to all troops requiring a handgun. Officers were obliged to buy it.

The 1908 version is a further development of the 1902/06 Lugers, and functions as described earlier. It no longer has a grip safety, and the safety lever that has taken its place blocks the trigger bar. When the gun is put on "safe" the safety catch uncovers the word "Gesichert" – German for safe. The extractor was changed so that its top rim showed the word "geladen" (loaded) when a cartridge was in the chamber. It was fitted with a hold-open latch, operated by the thumb stud of the (empty) magazine, that kept the breech open after the last shot. The first 08 models did not have this device.

The 1908 model is 225 mm long, has a 100 mm barrel with six rifling grooves, and is chambered for the 9 mm standard Luger cartridge. It weighs 0.870 kg, with all accessories 1.245 kg.

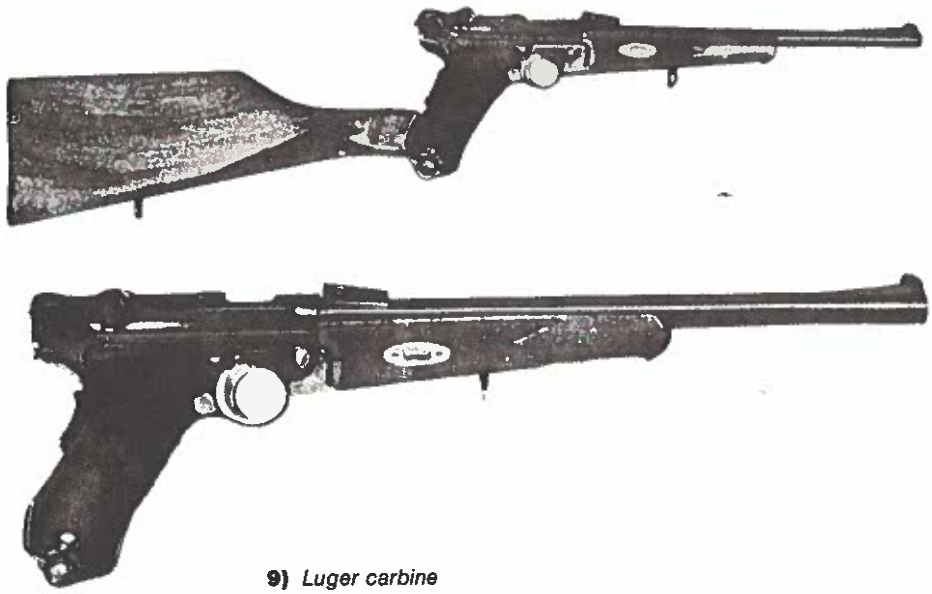
The cartridge (9 mm) weighs 12.1 g complete, the bullet 8 g and the charge 0.36 g. With a muzzle velocity of 320 mps the range is 1,600 m, whereby a 35° angle of elevation is required. Accurate range without sight elevation is about 75 m. At 25 m the bullet penetrates 15 cm of dry pinewood, and at 50 m 25 cm of dry sand.

The pistol and its accessories (spare magazine, cleaning rod and screwdriver) are carried in a leather holster. The screwdriver is for removing the firing pin, and the grip plates. It is shaped in such a way that it is useful for quick-loading the magazine.

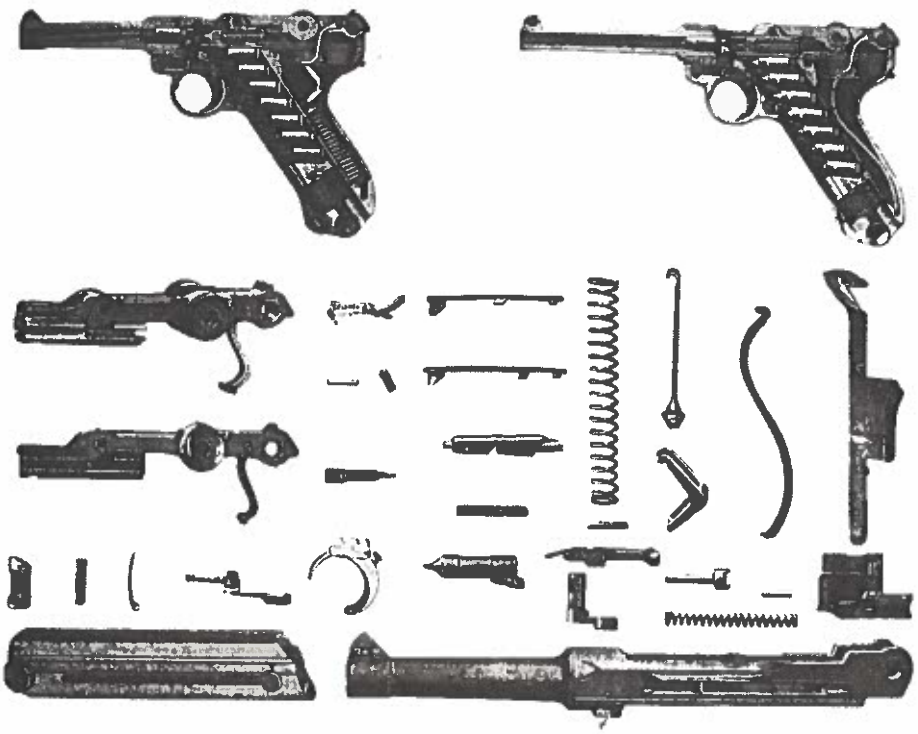
The German field artillery, who before WWI turned down the Carbine 98 (!), were issued with the long-barrelled Lugers. With the shoulder stock attached these troops wanted to use this pistol as a carbine. However, at the beginning of WWI they soon realized their mistake, and quickly returned to the Carbine 98.

These artillery Lugers had 200 mm barrels, and the overall length with shoulder stock was 680 mm. The shoulder stock, as with other models, was detachable, so the Luger could be used as a pistol, too. The shoulder stock for the artillerists had a leather holster strapped to it, as can be seen in the illustration. Otherwise it was fitted to the backstrap grooves of the Luger as described for the carbine model. The normal Luger also had these special grooves in the backstrap, to standardize production, although the first 1908 models were not so machined. A leather cap (see illustration) was placed over the metal catch of the shoulder stock, when not in use, to afford protection. The artillery Lugers, contrary to the navy Luger, have their elevating rear sights mounted on a thick section of the rear of the barrel. These sights are calibrated to 800 m. Both fore and rear sights can be screw adjusted for windage and elevation. The slant of the rear sight is designed for long-distance shooting.

Prior to WWI the Luger was offered commercially in 5 different models, viz:



9) *Luger carbine*



10) *Phantom views of 1906 model and 1900 model, with parts for both models (N/M = new model, O/M = old model)*

in cal. 7.65 mm with 120 mm barrel
in cal. 9.00 mm with 100 mm barrel
in cal. 9.00 mm with 150 mm barrel

These models were constructionally identical, but the pistol with 150 mm barrel was equipped with an elevating rear sight graduated to 200 m.

in cal. 9 mm Model 1908 (without grip safety)
in cal. 9 mm long with 200 mm barrel, rear sight graduates to 800 m.

The 9 mm Luger with 150 mm barrel had already been with the German navy since 1904.

Two experimental Lugers may be mentioned here that are rare collectors' items today. These are the Pocket Luger with 5-shot magazine in either 7.65 mm or 9 mm, and the Baby Luger for the Browning cartridge 7.65 mm. The first had the the normal size frame with a short grip and 60 mm barrel, the second had a small-size frame. The Baby, however, was not a success.

When the German army adopted the Luger, the firm of DWM was not able to meet the deadlines. The Royal Gun Factory at Erfurt, jumping into the breach, also started manufacture. Many thousands of Lugers were produced bearing the Erfurt stampings: a crown over the word Erfurt (of course, also proof marks and date). The serial numbers ran to 9999, and then to 9999 again, using a different letter. These letters prevented two guns having the same numbers.

World War I

The Luger cartridge originally had a flattened bullet. At the beginning of the war the Allies accused Germany of using a jacketed bullet having the characteristics of a dumdum projectile. In consideration of the fact that the British were using the Mark VII infantry cartridge and the French occasionally the illicit cartouche à'balle sectionnée this protest was questionable. However, Germany agreed to produce an ogive bullet, which was simpler to manufacture anyway. And from now on the alloy "tombac" was used instead of nickel, as nickel was badly needed for other purposes.

The long-barrelled Luger, excellent in balance, very effective at close ranges and quick to fire, was used as a sort of assault gun in position warfare. Even in the tangle of fire of the trenches the shortness of the Luger made it a formidable counterbattery gun. To overcome its "short-windedness" the 8-short magazine was replaced with a 32-shot version. Had this been a straight-line magazine it would have been very long indeed. A drum magazine was

designed (the drum itself holding 20 shots), attached to a straight-line magazine, which held another 12 shots. The cartridges were fed in a circle by spring pressure. To load the drum magazine a special filler had to be used to surmount the spring pressure.

Its effectiveness as a counterbattery and assault gun occasioned the military to experiment with the disconnector mechanism, to make it fire bursts or fully automatically like a machine gun. This plan did not materialize, for the pistol jumped so erratically that it just could not be held on target.

According to unofficial sources, DWM and Erfurt produced over 2 million 1908 Lugers during WWI. K. Zimmermann, the Swiss world champion marksman, writes in his book, "Die Schießkunst," Lucerne, 1942, that approx. 50,000 Lugers are in Swiss hands.

After WWI

After the Treaty of Versailles, production of the Lugers was stopped completely. This treaty specified that Germany might only produce pistols of up to 8 mm calibre with barrels not exceeding 100 mm. The new 100,000-man army was equipped with Lugers made by Simson & Co., Suhl, starting in 1922. DWM changed its name to Berlin-Karlsruher Industriewerk AG, and furnished the commercial markets with Lugers made up from pre-war stock. The Luger's design permits a change of calibre by changing the barrels, so the treaty specifications did not really worry the Germans much. The 7.65 mm Luger was produced from old stock with a 98 mm barrel, and was sold as Luger post-war, or Luger 23, with DWM markings.

The new German army, as well as the police, carried some of the original Lugers that had been left over from the war. To distinquish these as property of the Reich, they received a second date stamp on the receiver, 1920–1922. As at this date the German army was in the throes of reorganization, there are not many Lugers bearing a second stamping.

Most of the Lugers had been taken home by German ex-soldiers, only to appear again during the inflation when they were sold for high sums (although abroad the Mark was worthless at that time). Dealers bought them up, overhauled them, and sold them profitably to America and China. Military markings were often removed and replaced with commercial stampings.

As mentioned earlier, between 1922 and 1932 only the firm of Simson & Co. was allowed to produce Lugers for army and police purposes.

Pre-war stock from DWM could be used, but Simson & Co., Suhl, not DWM, appeared on the toggle.

Round about 1928 the trigger bar was changed on new guns, and on guns already issued to the troops. This measure increased the gun's safety in that it could be unloaded when the safety catch was applied. The new trigger bar ends with a slope just behind the cover plate.

Barrel inserts were made to enable cheap target practice with 4 mm centre-fire ammunition (e.g. RWS Mod. 20). The disadvantage of these inserts is that the gun can only be fired in single-shot fashion. The marksman does not get the feel of a self-loading pistol.

About 1930 a .22 attachment was marketed which enabled the Luger to fire semi-automatically. The firm of Geipel of Erfurt produced these under the name ERMA. It is interesting to note that the firm of ERMA moved to Dachau in 1945, and has been producing, since about 1966, a .22 pistol which looks very much like the Luger.

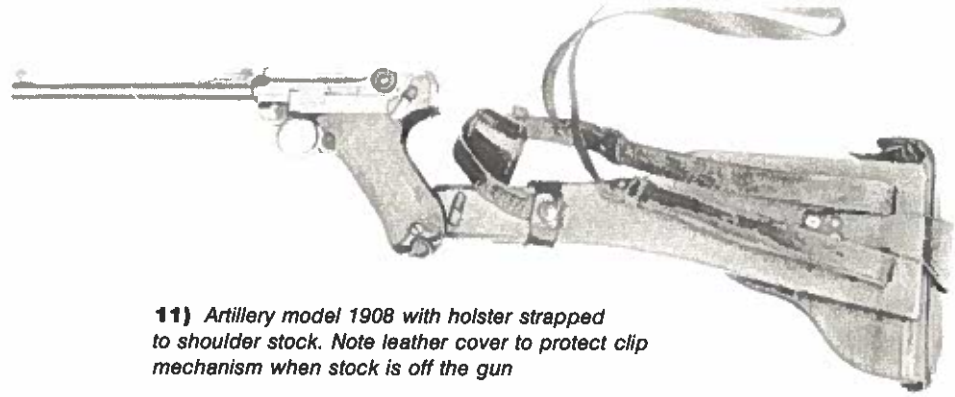
A few years after WWI a collapsible Luger stock was put on the market. However, this Benke-Thiemann system did not succeed. At the beginning of 1930 the Berlin-Karlsruher Industriewerke stopped all production of the Luger and transported the machines to the Mauser Works in Oberndorf (Neckar). When Mauser started production, Simson & Co. did not find it profitable to continue, as they only made small numbers for the army, and so closed their Luger production shops in 1933.

For years, German politicians had been trying to rescind some of the articles of the Treaty of Versailles. As far as pistol manufacture was concerned, they were successful. Since the cylinder of a revolver could not be counted as part of the barrel, the chamber of a self-loading pistol could also be deducted when calulating the length of the barrel.

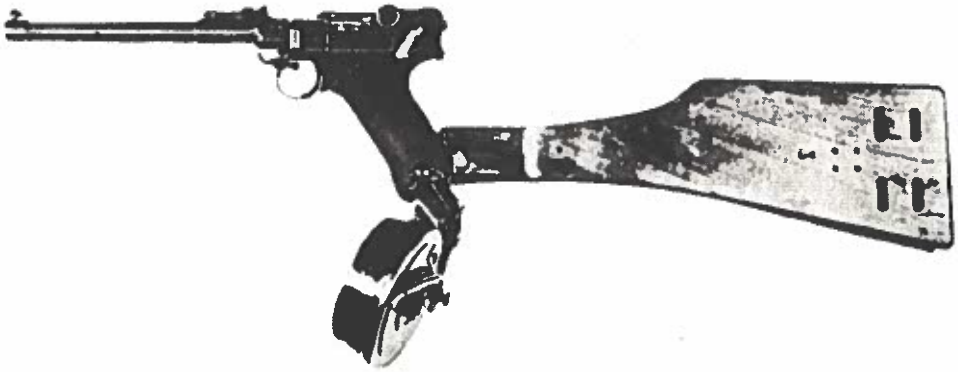
And the production of 9 mm pistols was once again legal in Germany.

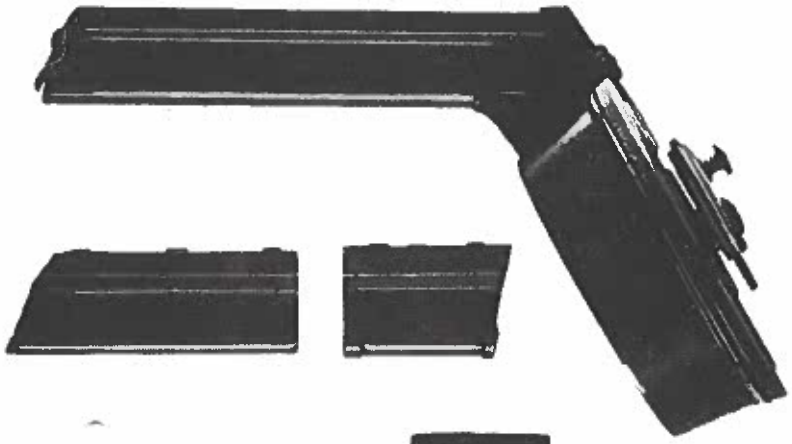
The Mauser-made Lugers bore the old DWM insignia until 1934. After this date, all Lugers destined for the commercial markets received a Mauser stamping.

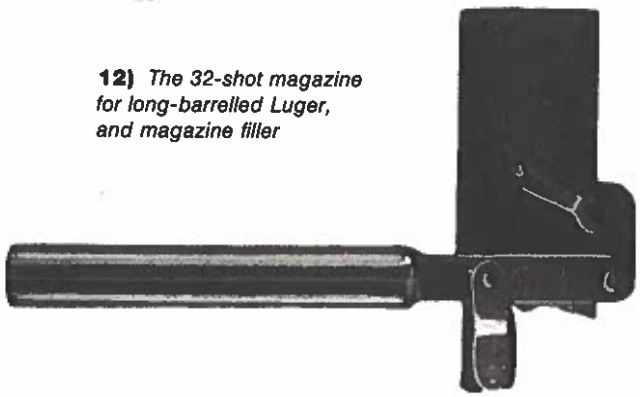
On military Lugers, Mauser stamped an "S", later "S 42" with a coded production date. "K" stood for 1934, "G" for 1935. Starting 1936 the military pistols received the year stamped on the receiver head in letters, and "42" replaced "S 42". Although during the year of 1936 models with "42" and "S 42" were produced. From 1940 onwards Lugers were no longer exported, and commercial models were issued to the army. The Mauser stampings remained on these pistols, and the receiver heads bore the year of production or year of adoption. In addition to "S 42" or "42"



11) *Artillery model 1908 with holster strapped to shoulder stock. Note leather cover to protect clip mechanism when stock is off the gun*

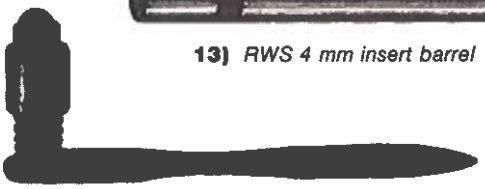






12) *The 32-shot magazine for long-barrelled Luger, and magazine filler*

13) *RWS 4 mm insert barrel*

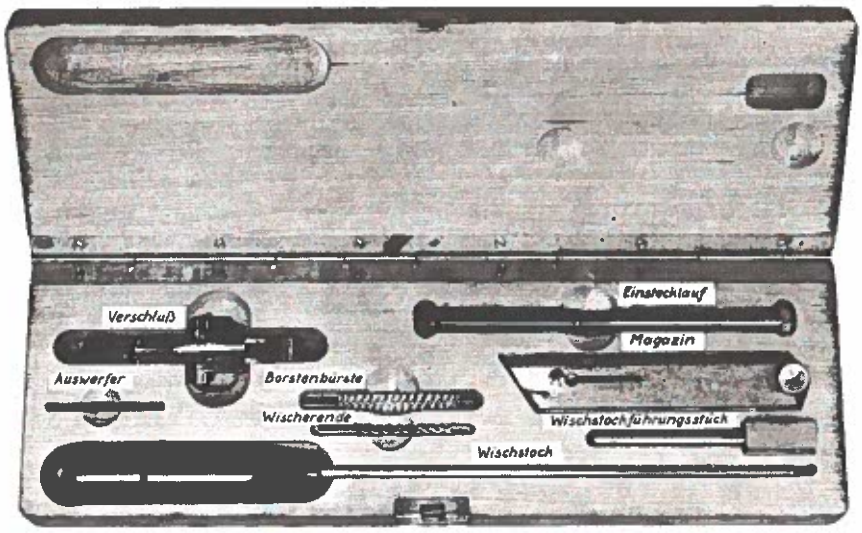


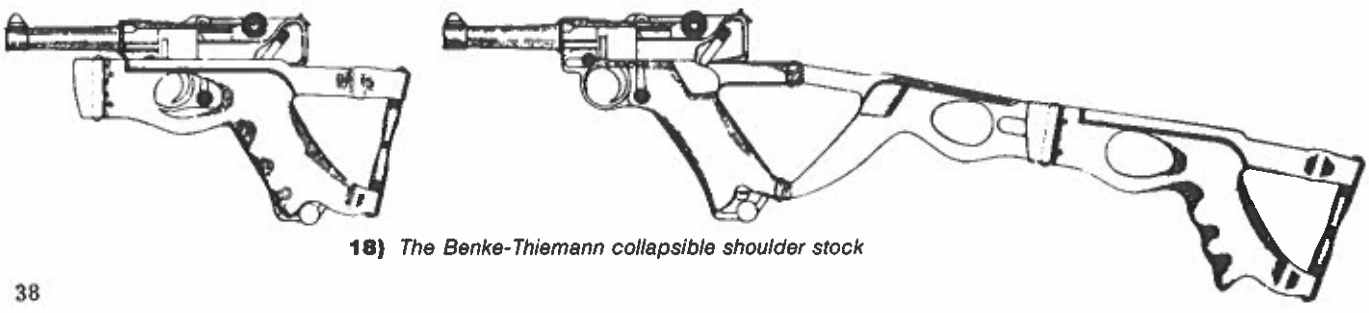
15) *RWS loading device for insert barrel*

14) *Ammunition, 4 mm centre-fire*

16) *Luger converted to fire .22 ammunition semi-automatically*

17) *Parts of the .22 conversion kit.*





18) *The Benke-Thiemann collapsible shoulder stock*

a "byf" appeared. All Mauser-produced pistols of the Second World War bore this sign. Most of these "byf" models have black plastic grip plates.

However, Mauser was not the only producer of Lugers. Heinrich Krieghoff, of Suhl, manufactured Lugers for the Luftwaffe, starting in 1935 as Mauser's capacity had already been reached. Krieghoff received the parts for fitting together; a few of these Lugers reached the commercial market. The military Lugers were stamped only with an "S" on the receiver head, which also bore the year of production, 1935.

The commercial Krieghoff pistols bore an anchor with a dagger-like centrepiece pointing downwards, on the toggle assembly. The words "Heinrich Krieghoff, Suhl" (in two lines) were under this anchor. This series usually had a "P" in front of the number, and was sold on the commercial market.

In 1938 the German armed forces replaced the Luger with the Walther P 38. However, the Luger was manufactures till 1942, until sufficient numbers of P 38s were available. After WWII, between 1945 and 1946, the Allies got Lugers fitted together from old stock; The French at the Mauser Works in Oberndorf, the Americans at Krieghoff in Suhl. Only a few hundred pieces were produced in this way and nothing can be said about their stampings, or numbers.

In Switzerland, Lugers were fabricated between 1924 and 1948 at the state gun factory in Berne.

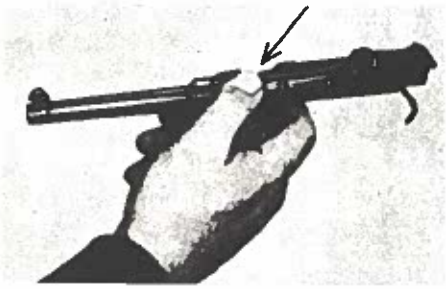
The Dutch purchased their Lugers for the army from DWM, long before WWI. Germany could not deliver during the First War, and was not allowed to after it. Between 1924 and 1926 Vickers Ltd., of London, produced about 10,000 Lugers, corresponding to the model 1902/06, for the Dutch army. On the left-hand side of the receiver these Lugers bear a crown and the letter "W", English proof marks and the name "Vickers" on the front toggle.

There comes a day when even old faithfuls are dismissed! Hence the very trusty and popular Luger, after 30 years of army service, is replaced by a better and simpler weapon, the Walther P 38. The Troops were not complaining, the reasons were as follows:

The Luger was conceived at the turn of the last century, at a time when modern mass production techniques could not be considered. Many parts of the Luger were hardly interchangable, so skilled gunsmiths had to fit them by hand. The Luger had become too expensive. It cost nearly as much as the 98 k infantry rifle.

Another factor was the great number of accidents that occurred with the Luger, and, unfortunately, always will occur.

Before stripping the Luger it is very important that no cartridge is in the chamber. Even when the barrel has been removed from the receiver and trigger mechanism, a shot can be fired. Slight pressure on the trigger bar, which protrudes from the side of the barrel extension, will prove fatal. As the barrel is usually pointing downwards when slid off the receiver, the victim is hit in the liver, which in most cases ends in death. Many such accidents happened each year when the German country police were issued Lugers between the wars. The soldiers in barracks, in times of peace, were not so endangered, owing to ammunition being strictly locked away and the careful instruction in cleaning and dismantling the Luger they received. In the field, though, it was another matter ...



19) *The Luger's weak point (see text)*

Dreyse's needle gun of 1835 created the basis for Prussia's turn-bolt breech loading rifle with standardized cartridge. His constant efforts, singleness of purpose and bulldog tenacity helped produce a military weapon of undisputed value for his country.

THE DREYSE

Following the development of ignition systems in small arms prior to the metallic cartridge, our path leads us from the cannon lock and matchlock to the wheellock, and from the flintlock to the percussion lock. However, these were all muzzle-loading systems, although gun designers had been trying for years to invent a breech loader. In 1812 Pauli, a Paris gunsmith, presented a breech loader that chambered a brass cartridge. In fact, this new cartridge was fitted with priming compound and ignited with a firing pin. Although ahead of its time this system was not a success, for the thick walls of the cartridge case could not expand to make the breech gas tight. At that time a Nikolaus Dreyse from Soemmerda/Germany was apprenticed to Pauli, and when he returned home he attempted to improve on the French invention. He, too, was unsuccessful with the brass case and set about finding other ways of constructing an all-in-one cartridge. Dreyse then experimented with a long needle that was driven into the primer by a spring. His first rifle, a muzzle loader, appeared in 1827. The round or oval bullet with a detonator-propellant unit in its base rested in a wooden support. As premature-ignition sometimes occurred when loading, Dreyse had to fall back on powder loads as a propellant. To prevent the bullet from compressing the powder, Dreyse used a needle guide that extended into the breech.

To stop the bullet from rolling out of the barrel a check screw was applied to the side of the frame, then a pin. After a while Dreyse placed the needle and needle spring inside the barrel, and cocked the mechanism with a bolt handle.

By 1832 the Dreyse gun used standardized ammunition, but was based on the Pauli model.

Josef Cloth

14 illus. by the author
1 illus.: Scholz
Reference: Thierbach; Eckardt-Morawitz "Feuerwaffen" von Dudley Pope, Scherz-Verlag, Munich
The M 62 needle gun illustrated was kindly lent to the author by Dr. Franz Bott.

NEEDLE GUN

Left and right views of Model 62 (bolt closed).

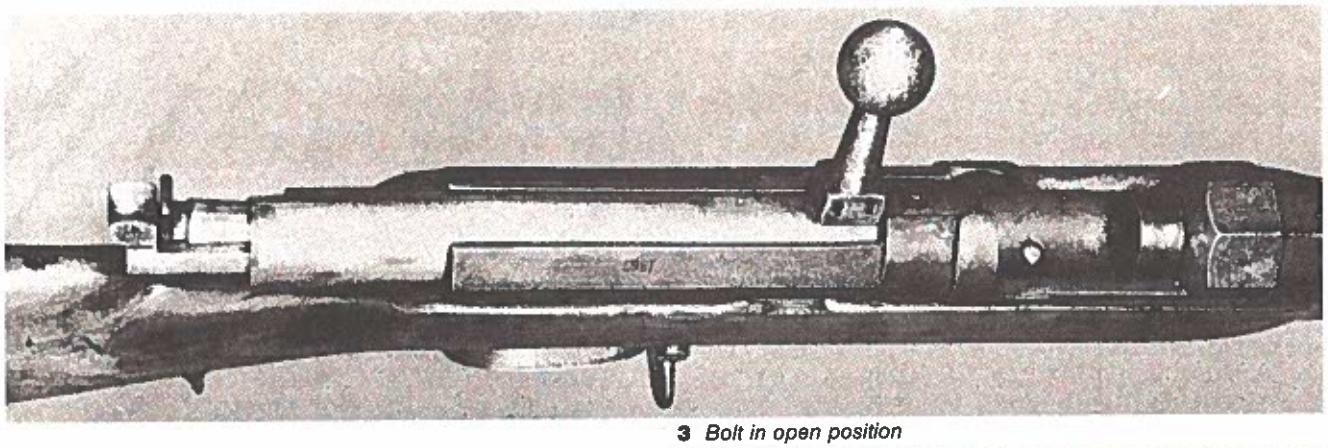
The needle gun was the first firearm with trigger slack, the sear engaged with the firing-pin carrier as is customary today.

An intermediate phase was the so-called Traubengewehr of 1834, a muzzle loader that underwent troop trials. In 1835 another muzzle loader with cylinder lock and conical bolt followed suit. In the same year a muzzle loader needle gun with a movable bolt made its appearance.

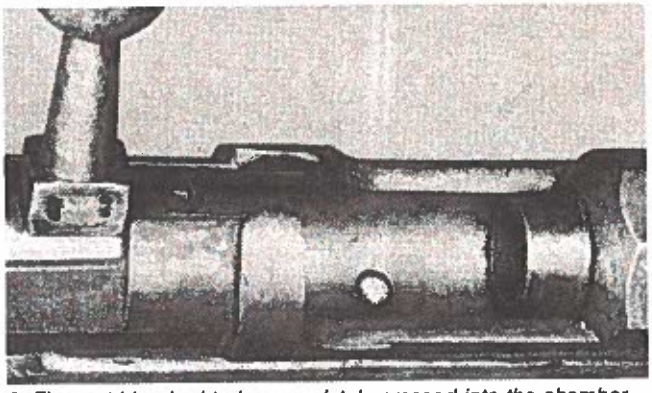
It was now but a short step for Dreyse to introduce a properly functioning breech loader, also bearing in mind that France had adopted a lifting breechblock system in 1831. By sliding a bolt in the receiver a cartridge could be placed in the chamber at the breech end. During this period European armies were equipped with muzzle loaders, and the troops were

1 *Receiver stampings*

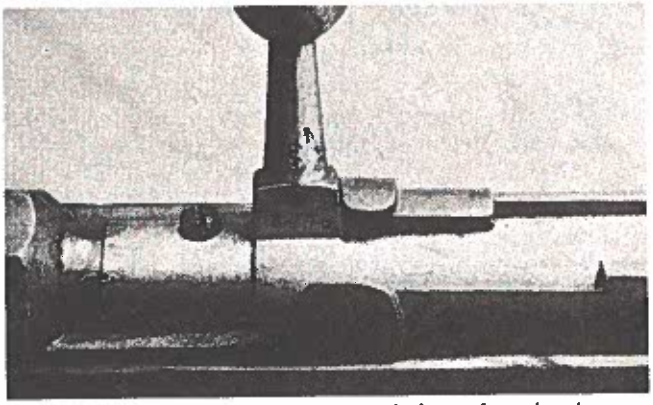
2 *KA = short buttstock*



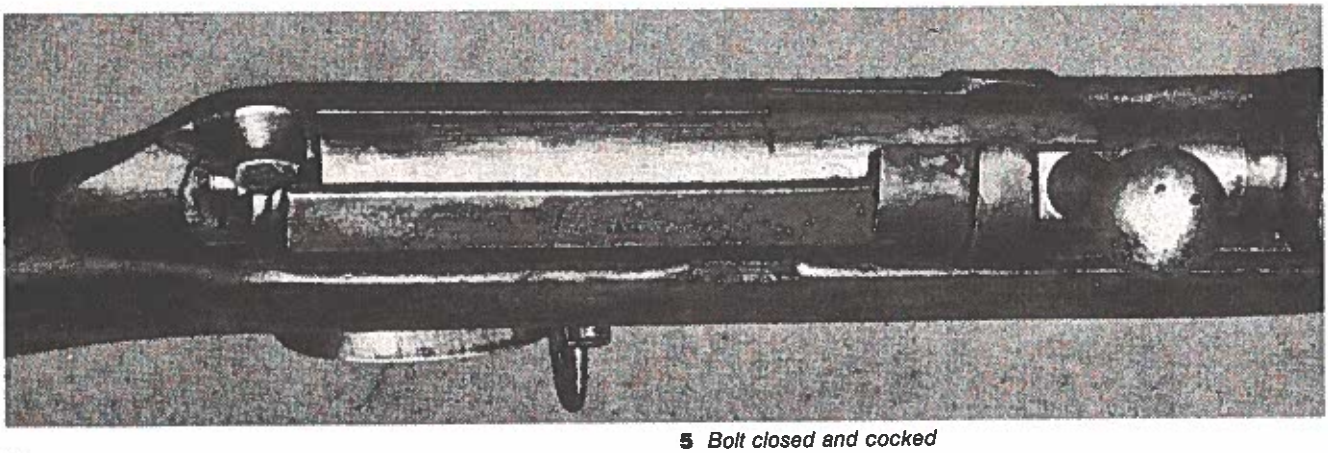
3 *Bolt in open position*



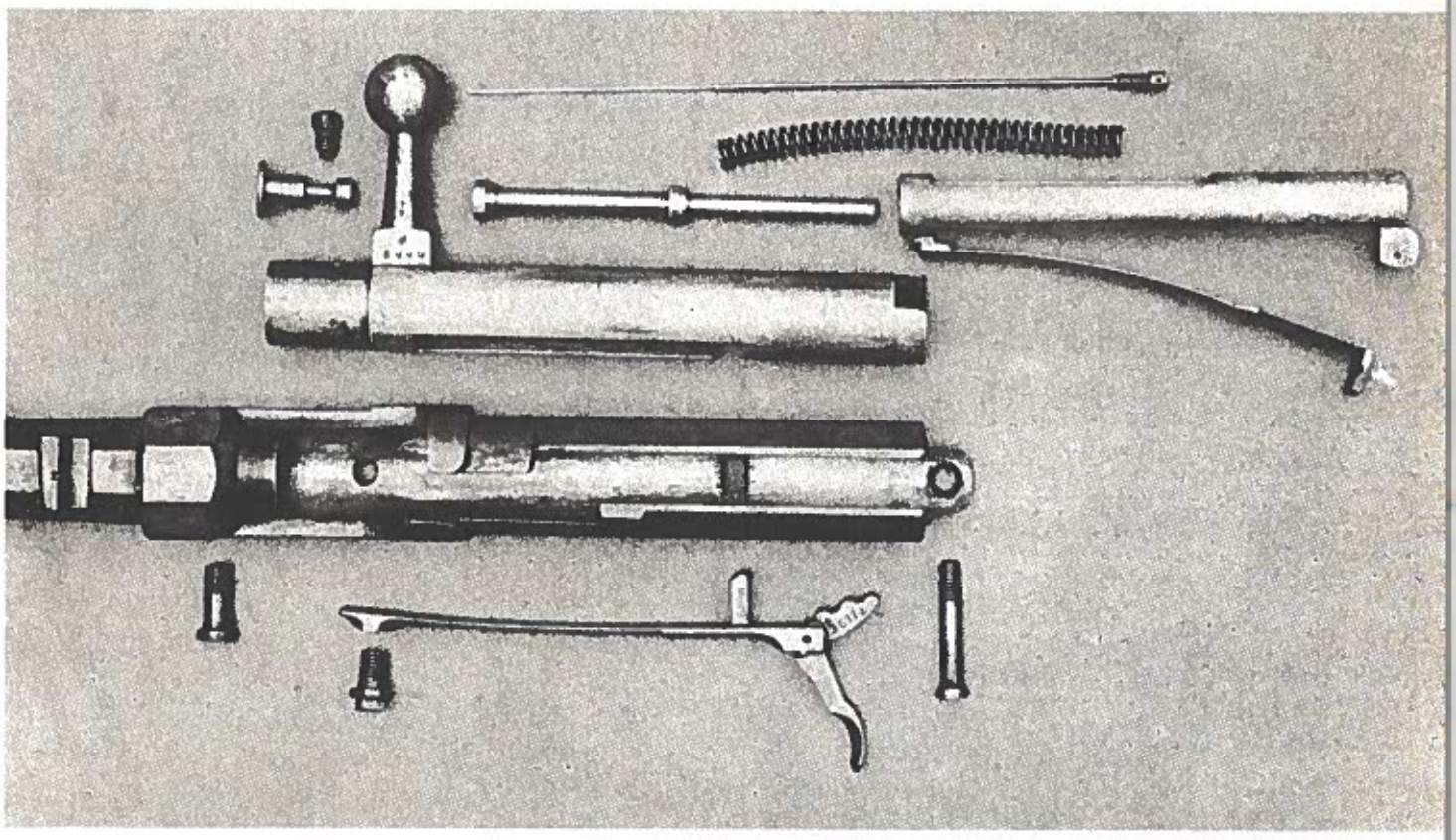
4 *The cartridge had to be completely pressed into the chamber*



6 *Bolt is locked when handle engages in front of receiver lug*



5 *Bolt closed and cocked*

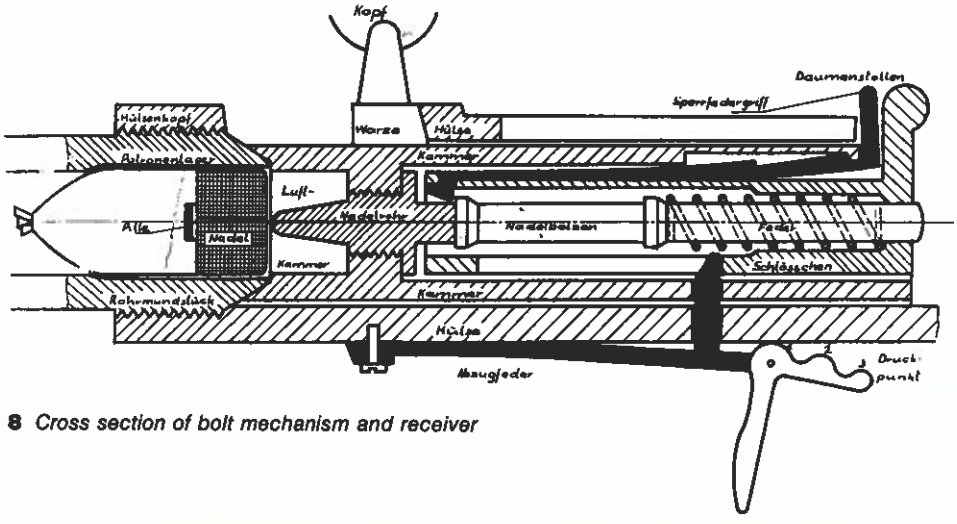


7 *Parts of Beck's improved bolt. Rubber obturator not shown.*

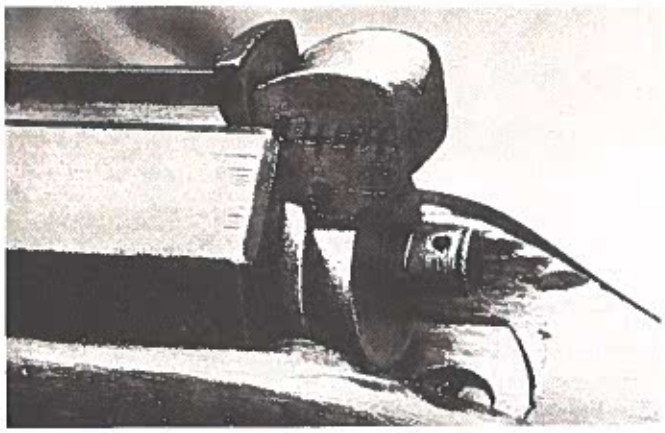
thus obliged to re-load in a standing position. The breech loaders, on the other hand, could be loaded in a prone position, which was most propitious for new field tactics. Breech loaders were easier to re-load and quicker to fire than muzzle loaders, used standardized cartridges, and were relatively simple to keep clean.

Prussia was the first state to fully equip its army with a needle breech loader. Although Dreyse was supported by people in high-up goverment circles, it was not until 1840 that he received an order for 60,000 pieces. In order to keep the new, rapid loading rifle a secret it was designated "light percussion rifle." Dreyse, who in the meantime had been raised to the nobility, set up a gun factory at Soemmerda and delivered the Prussian army 39,000 rifles by 1847. Other state-run factories also produced the Dreyse.

Quite a number of improvements were made and the illustrations here show the Model 62 that underwent changes in 1872 by Beck. Fig. 3 shows the action open, Fig. 5 the action closed, Fig. 7 the bolt which field strips without any tools, and Fig. 8 is a sectional view of the receiver and bolt mechanism. By turning the bolt handle in front of the receiver lug, the bolt assembly is locked to the breech. When the catch at the rear of the bolt is depressed the inner sleeve can be drawn back and pushed forward again, via the thumbpiece, to cock the firing needle assembly. In the early models, a space was milled out in the face of the bolt to faciliate cleaning. As seen in Fig. 8,



8 *Cross section of bolt mechanism and receiver*



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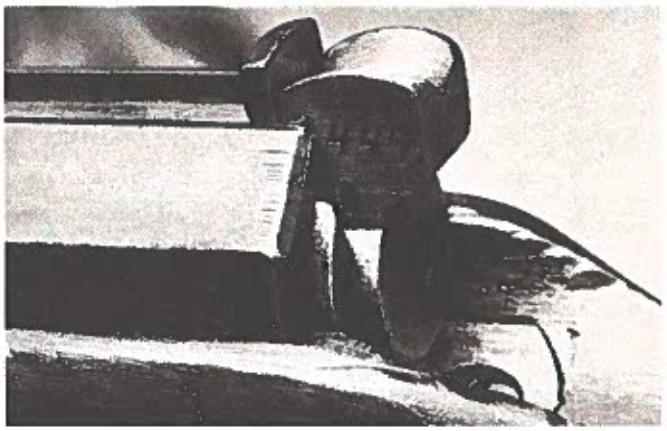

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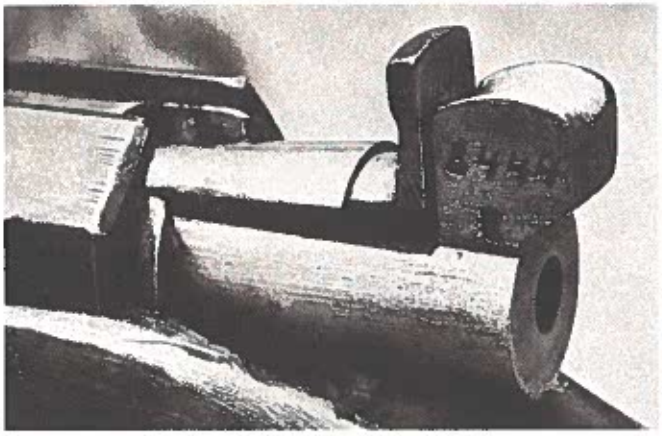

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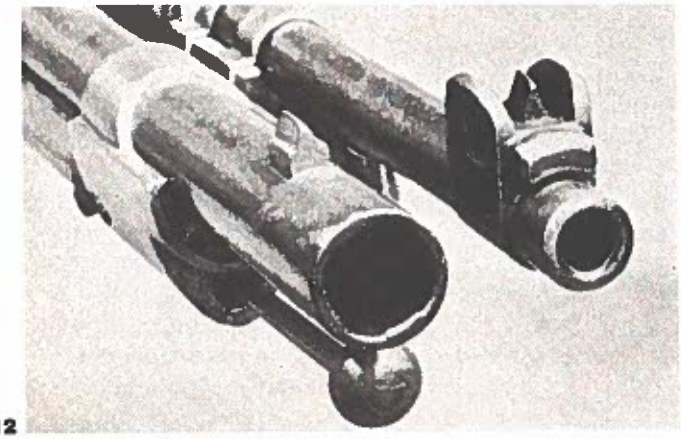
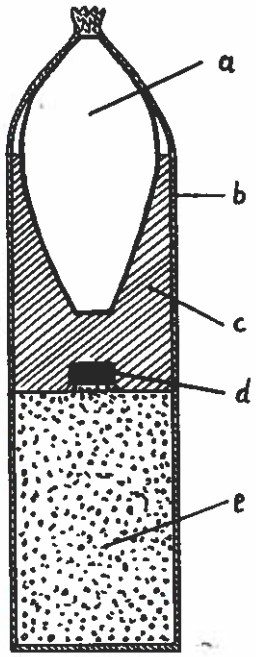


12

9 *Bolt cocked. Note head of needle carrier*
10 *Gun has been fired, needle carrier no longer visible*
Bolt cannot be opened until sleeve is withdrawn via thumbpiece
11 *Sleeve withdrawn, main body of bolt can now be opened*
12 *Calibre comparison between the needle gun and the carbine 98.*



13 *1855 paper cartridge*
a) overdimensioned boattail bullet
b) manila paper
c) cardboard prop
d) primer
e) blackpowder

the needle housing could be unscrewed and removed through the rear of the bolt. Trigger slack was employed for the first time on this rifle and, as shown in the sectional drawing, the sear engages with the lip of the needle carrier. To seal off the breech the face of the bolt is machined to fit over the slanting walls of the chamber. The needle assembly can only be cocked when the bolt is locked to the breech.

On account of the air chamber in the face of the bolt, ballistic performance was poor. Beck improved on the design by sealing the breech with a metal covered rubber obturator that fitted into the bolt face. When the bolt was locked the obturator protruded a short way into the chamber.

The following needle guns were used in Prussia:

The M 41 and M 62 infantry rifles, the M 60 fusilier rifle, the M 49, M 54 and M 65, the U/M and M 69 pioneer rifles, the M 57 carbine, and the M 56 pistol.

As said earlier, the model illustrated here is the M 62 that was perfected by Beck after the 1870/71 Franco-German war.

The barrel measures 840 mm, the bore diameter 15.43 mm with a tolerance of 0.13 mm. The barrel has four grooves 0.78 mm in depth. Lands and grooves both measure approximately 6 mm in width. Length of twist 732 mm. Fig. 12 indicates the difference in calibre between the needle gun and the carbine Mod. 98. The needle guns were equipped with cleaning rods. The stocks, which were furnished with brass bands, brass trigger guard and a steel butt plate, came in two lengths. They were either marked LA or KA (long and short version), and showed 1.95 cm difference in length (Fig. 2). The M 62 was issued with a triangular bayonet blade. The barrel of the M 41 measured 907 mm, overall length 1430 mm, weight with bayonet 5,336 kg. The M 60 and M 54 had barrels measuring 785 mm.

Fig. 13 shows a cross section of the paper cartridge of 1855. The needle passes through the black powder (e) and strikes the primer (d). The theory was that positioning the primer in the middle would give the best combustion. The support or prop (c) was designed to keep the bullet on a straight path, and to act as a gas seal. Dreyse experimented with round lead projectiles, then with pointed ones, and finally suggested iron bullets. Since iron rusted to the cardboard guide props (c), bullet and prop left the barrel together in one piece, causing so-called whizzers, Dreyse had to fall back on lead projectiles. In 1855 the overdimensioned boattail (Fig. 13) was adopted, which, too, often refused to separate from its guide prop.

The diameter of the bullet was 13.6 mm, length 29.6 mm, weight 31 g, The blackpowder load, weighed 4.83 g, and the complete cartridge 38.5 g. The ballistic coefficient averaged 31.3 g/sq. cm, muzzle velocity 296 mps, muzzle energy 139 mkg, twist 408 rps.

Penetration in pine wood was as follows:

at 100 m = 12 cm
300 m = 9 cm
500 m = 7 cm
800 m = 4 cm

Maximum range was about 800 metres.

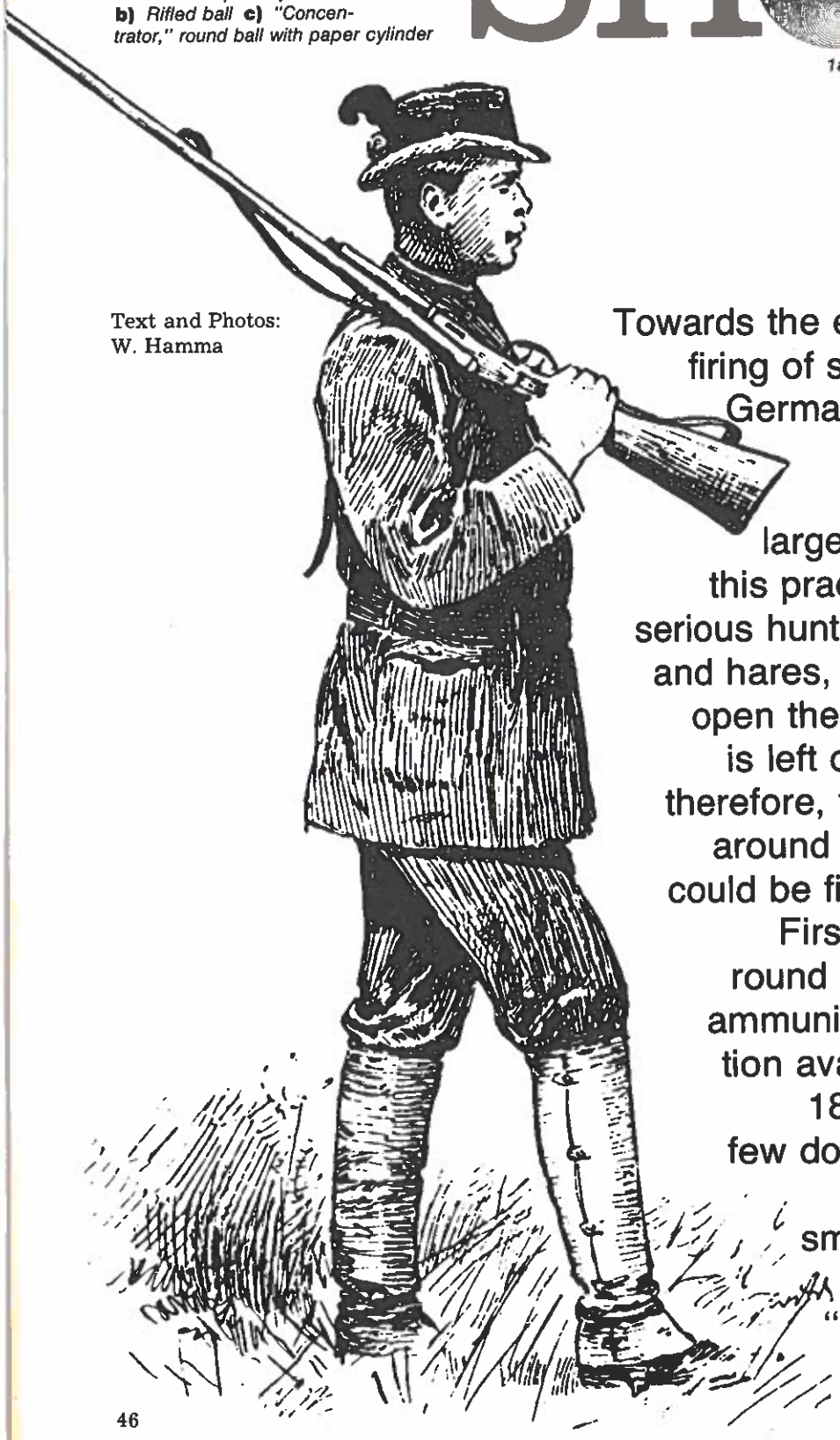
In 1872 the bullet described and depicted in Fig. 13 was changed, as were the sights of the rifle. The calibre was reduced from 13.6 to 12 mm, the length of the cartridge from 61 to 56 mm, weight from 38.5 to 30.7 g. The bullet itself was reduced in length from 26.9 to 24.6 mm, weight from 31 to 21 g.

THE DREYSE NEEDLE GUN

SHOTGU

1a

1 *Basic shapes* **a)** *Round ball* **b)** *Rifled ball* **c)** *"Concentrator," round ball with paper cylinder*



Text and Photos:
W. Hamma

Towards the end of the last century, the firing of shot at deer and wild pig in Germany was not exactly outlawed, but because of the ineffectiveness of shot on large animals at long distances this practice was frowned upon by serious hunters. If, when hunting foxes and hares, wild pigs dash out into the open the sportsman with a shotgun is left out in the cold. No wonder, therefore, that hunters began looking around for some sort of bullet that could be fired in smoothbore barrels. First they tried the well-known round ball, then large calibre rifle ammunition. According to information available to the author, about 1870 a few gunsmiths and a few do-it-yourself hunters experimented with slugs for smoothbores; after the round ball and the so-called "cat heads" (Fig. 2) for big-calibre rifles had failed.

N SLUGS

1b

1c

There is but scanty information in the hunters' magazines (e. g. Deutsche Jägerzeitung up to 1900) about these experiments, thus many tests will never come to light. The first epoch-making success was achieved by von Witzleben when he introduced a bolt slug more accurate than any other type known at the time. When, in early 1894, the Deutsche Jägerzeitung published results of tests conducted by the Halensee Small Arms Experimental Station in Berlin, the news created a mild sensation. Up to that point in shotgun history no other slug worth mentioning had been introduced, apart from H. Panzner's "arrow" that apparently did not catch on with hunters.

The success of von Witzleben's bolt slug, and the interest aroused in shotgun slugs generally by the article in the Deutsche Jägerzeitung, occasioned a host of inventors to don their thinking caps; so before long a whole series of new-fangled slugs tumbled on to the market. All sorts of new shapes appeared, some amateurish without any understanding of ballistics, others of good design. The most successful of all was the Brenneke slug, which, after many modifications, is probably still the most popular shotgun slug throughout the world, some 70 years after its introduction. Another competitor was the Stendebach-Ideal, perhaps remembered by some of the older hunters.

Firing ball from a smoothbore was a makeshift proposition right from the start, and intended only for short-range work, as stated by von Witzleben in the April edition of "Der Deutsche Jäger" when he wrote: "After a lot of trouble I invented the new shotgun projectile which, in theory and practice, nearly equals the properties of the rifle bullet at 60–80 metres, not because I wanted to oust the good old, trusty rifle, but because I wanted to make the shotgun's barrels, when needed, as suitable as possible for firing bullets."

Even today this view still holds good. Reliable range, accuracy, stopping power have always been controversial points with slugs. Underestimates and exaggerated expectations have caused confusion, bringing shotgun slugs unjustly into discredit.

I shall now describe a number of different slugs, their history, etc., but must say reliable sources are very difficult to come by; regarding most developments only names and illustrations exist, no data on performance, etc. In many instances we shall be dealing with prototypes that never left the experimentation stage.

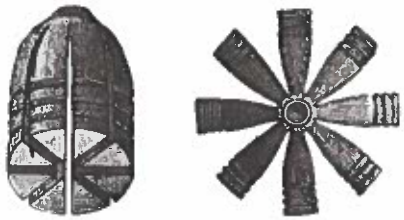
These are interesting as examples of inventors' delusions, when a knowledge of ballistics is lacking, or examples of fantastic imagination. Mahrholdt's "Waffenlexikon," and Preuss's "Lehrbuch des Flintenschießens" cover this subject rather well. Otherwise one finds a short description of shotgun slugs in practically every book on hunting, and in hunting and gun magazines, such as (in Germany) "Der Büchsenmacher," "Kugel und Schrot," and "Jagdzeitschrift."

The beginnings

The oldest and best known one-piece shotgun projectile is the round ball. It was probably the most widely used slug until von Witzleben introduced his bolt slug in 1893. Dispersion was so great that at 30 to 40 metres nothing could be hit. And anyway, round balls are not suitable for firing in choked barrels. Quite a number of attempts were made to circumvent this inconvenience. But neither the "concentrator bullet" (Fig. 1c) (a round ball wrapped in a cardboard jacket), nor the round ball wrapped in lubricated canvas, nor the round ball embedded in a jacket with paraffin wax, solved the problem. The so-called rifled slug (Fig. 1b), designed to improve accuracy, was also a flop.

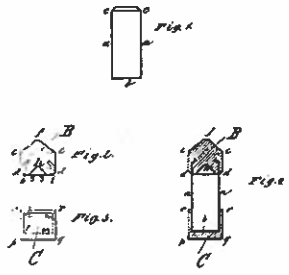
2a *The so-called "cat-head," a lead ball cartridge*

2b *Cross section of live round*



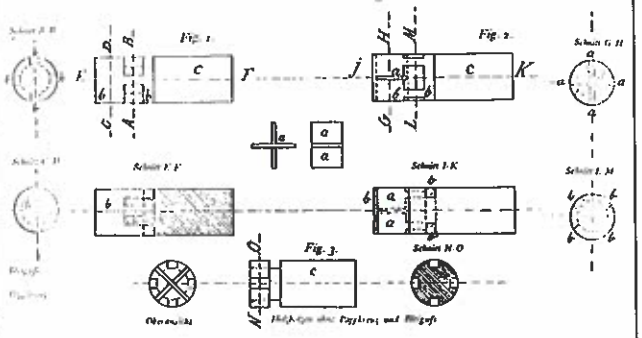
2c *Berntheisel-Luneville, or star shot*

4 *The Paradox slug (English)*

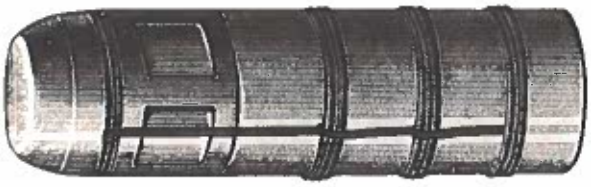


5 *The Panzner arrow slug*

6 *Von Witzleben's first slug*



6a *A patent drawing of specification No. 73672 (August 2, 1893)*



6b *Specimen with wool yarn harness*

The poor performance of the round ball and fear of burst barrels when firing one-piece projectiles in shotguns, goaded the inventors on to find something new. Let us look at Figs. 2 – 4 which illustrate a number of slug types that appeared at the turn of the century and were failures. Fig. 2a shows a so-called cat-head, a heavy round ball designed actually for large-calibre Lancaster or Leufaucheux rifles, but were used in shotguns with cylinder chokes. To increase stopping power Berntheisel-Luneville slugs were sometimes used, which opened up like a star on impact (Fig. 2c).

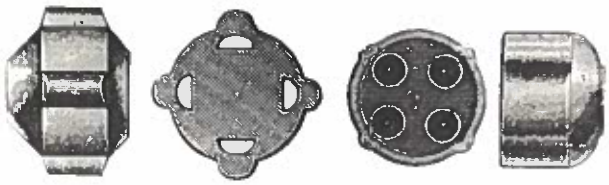
As can be appreciated, these slugs were horribly inaccurate. Fig. 3 presents slug designs for use in choked barrels, or slugs that rotate, or should rotate, for stabilization. Fig. 3a shows Oberhammer's projectile, the wings of which are pressed into hollows when the projectile passes through the choke at the muzzle end. Oberhammer was a Munich gunsmith who became quite famous. Köhler's slug (Fig. 3b) sported a wire guide satelite. André-Charleroi's hollow projectile (Fig. 3c), designed to rotate within the barrel, was the forerunner of the Stendebach slug. Gevelot's shell case with inside rifling to match grooves on the bullet (Fig. 3d) to impart rotation thereto, was just as unsuccessful as von Witzleben's test slug (Fig. 3e) with a hole running through the core, or the cluster of shots, 5 to 7, papered to a heavy base (Fig. 3g). Fig. 3f shows a French slug of 1900, which also proved unsuccessful.

Then there was the Lyon lethal-slug, which , split into 12 segments, burst like grapeshot upon impact. The destructor-slug by Kynoch resembled a rifled slug (Fig. 16), but consisted of a thin lead mantle with a post as filling.

However, I think I have given you enough examples of bad design, although later on we shall come across a few more of the unsuccessfuls. The projectiles illustrated in Fig. 3 all suffer from flight instability, e. g. when leaving the barrel they tumble and veer off course. That an elongated projectile with a spinning motion usually lacked the propensity to tumble, was, of course, generally known. What was not known was how to impart a spin to a projectile leaving a smoothbore barrel.

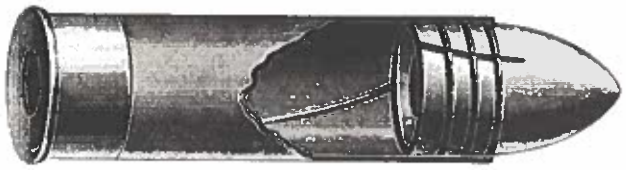
Some designers tried to overcome this obstacle with hollow slugs having curved inside guide ribs (André, and later Stendebach), others with outside guide ribs (Brenneke). It was believed that air resistance could be utilized to impart sufficient spin to a smoothbore slug, enabling it to fly as true as a rifle bullet. But such hopes were not fulfilled, for the slugs turned somersaults as merrily as before. More recent investigations (The American Rifleman, Au-

3 *Early slugs*



3a *The Oberhammer*

3b *The Köhler with wire satellite guide* **3c** *The André-Charleroi*



3d *A rifled cartridge case to rotate special projectile*

3e *A von Witzleben prototype*

3f *French slug for choked barrels*

3g *Five-part slug, each part papered to metal base*

3h *Seven-part slug, each part papered to metal base*

gust, 1963) show that modern slugs with inclined outside ribs (Foster, Brenneke) produce a slow spin of about 3,600 rpm, as compared with the spin of 100,000 to 200,000 rpm for rifle bullets. Such low spin is not in itself sufficient to stabilize the slug; but experience has shown that arrow-stabilized (weighted tip) slugs with inclined outside ribs have a definite edge over those slugs having only straight ribs. This finding is plausible.

England's Paradox slugs (Fig. 4) occupy a special position. They were fired from special shotgun barrels that were a cross between smoothbore and rifle barrel. These guns were used in the colonies, and won themselves a good reputation for slug accuracy, it is said, although normal shotshells did not function quite so well in these barrels.

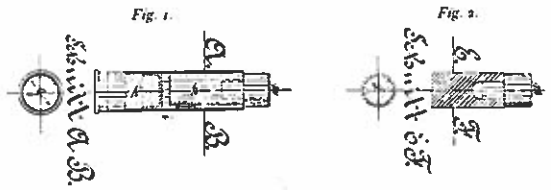
However, the first all-out success must be ascribed to von Witzleben's bolt slug of 1893. In the magazine "Der Deutsche Jäger" of 1898, he admitted that his invention rested on the quarrel of a crossbow. Stabilization was achieved by shifting the centre of gravity to the front (as is the case with quarrels and normal arrows). All the same, von Witzleben was not the first person to try to apply this many hundred year old principle to smoothbore slugs.

In March, 1886, Hubert Panzner of Austria-Slesia patented an arrow projectile for firearms. The patent specification states that the projectile (Fig. 5) consist of lead slug (B), the connecting tube (a) (of iron, copper or brass), and the base cap (C) (of glued packing paper). This projectile, however, seems to have been known only to a small circle of hunters, although an article appeared on it in the "Deutsche Jägerzeitung," in Feb., 1887.

G. Koch, the well-known hunter-ballistician, published results of a series of tests with Witzleben's bolt slugs at a distance of 80 metres, whereby he managed to prove the interdependence between the construction of the barrel, powder load, and shot performance. One of his shotguns, loaded with 4.5 g blackpowder, placed 10 slugs in a 15 x 17 cm target at 80 metres. Even today, this would be top performace.

Von Witzleben's prototypes (Fig. 6 a) consisted of a cylindrical wooden block with cutouts (3), upon which a lead slug is cast (1 or 2). Before pouring in the lead, a cardboard cross was placed in the bolt to form the underside of the slug into four parts, the top side of the slug being only 2 mm thick. This was to impart a mushroom effect when the slug hit the target. The bolt slug could only be fired from cylinder choked barrels and required as stabilizer three grooves and a wool yarn harness, which acted as sealant and guide in the barrel (Fig. 6b).

A 16 gauge projectile measured 50 mm in length,



7 *New von Witzleben slug*

8 *Various specimes of von Witzleben's slugs (c. 1905)*

9 *Von Witzleben's "Granate."*

10 *The Kettner slug*

11 *Other special slugs*

11a *The Bougnet slug*

11b *The Böger, the split wooden bolt was to press against the inside of the barrel.*

11c *The Daehne slug, the shaft was filled with felt*

16.5 mm in diameter, 16.3 mm at its end, and 17.5 mm around the harness. There was a normal felt wad between powder and slug, and the complete shell measured approx. 97 mm, the slug standing very proud of its casing.

Von Witzleben endeavoured to improve his invention and patented in 1897 a new type (Fig. 7) for choked barrels, which proved more popular. The smooth wooden bolt was replaced by a bolt with longitudinal splines (Fig. 8), an arrangement which also simplified the casting of the slug. As the diameter of both slug and bolt was less than the tightest choke known for a specific gauge, the new Witzleben could be fired from choked shotgun barrels without fear of any damage. Fig. 8 shows the forms available until 1905. It is not known to the author when total production of these successful slugs was stopped. Probably after WWI. Von Witzleben also developed a hollow cylindrical slug, mentioned elsewhere, which soon became known as "Witzleben's grenade." The centre of gravity was shifted to the front by using a cylindrical weight (Fig. 9). There is no further data available, presumably because it did not prove too great a success. After WW2 the Witzleben slugs were no longer manufactured.

In November, 1894, the Eduard Kettner gun factory in Cologne announced a new shotgun slug, which can be seen in Kettner's ad in Fig. 10. The slug, turned from iron, rests on a slit cardboard prop. However, the Kettner slugs were just as unsuccessful as those illustrated in Fig. 11. As far as is known, this Bougnet slug is still being produced in Belgium. Round about 1898 the famous Brenneke slug was introduced, and after modifications is still going strong.

Figs. 12 and 13 show a number of later versions. The 1920 model with hard lead point corresponds to today's slugs, all the others have been discontinued.

According to A. Preuss, the Witzleben, Brenneke, Kettner and Stendebach slugs were the most reliable in 1905.

Just as little is known about the Zeppelin slug (Fig. 12), which appeared later, as is known about the Sauer (Fig. 14) or the sub-calibre by Ernst Bickel (cf. Mahrholdt). Not much is known about the Mahrholdt-Peterlongo either.

For those of my readers interested in the old-type shotgun slugs I refer to P. Thürmer's patent of 1932, and F. Stendebach's patent (Augsburg) of 1933. However, neither of these slugs reached the market.

More recent developments

After World War II, when German hunters were

12 *Various slugs, end of the 1920s*

13 *A row of outmoded slugs. From left to right: Cathead, Split slug, Witzleben's Granate, Witzleben's slug, Brenneke, Brenneke, Stendebach, Stendebach*

14 *Sauer slug*

15 *Rottweils next to Brenneke slug. Left to right: 16 gauge, 23.5 g, model 1950–56; 16 gauge, 26 g, 6 staight guide ribs, model 1956–64; Brenneke slug*

permitted to use shotguns, and only shotguns, to regulate an overpopulation of game, there was a great demand for slugs. It is not surprising, therefore, that the well-known Brennekes, the Auerhahn, Express and Troisdorf, came into their own. The firm of Rottweil introduced two new developments under the name Waidmannsheil. The first slug (Fig. 15) has a solid head, a cylindrical mantle with longitudinal grooves for choked barrels, and was hollow. A felt wad was not fastened to the projectile, and stabilization was achieved by placing the centre of gravity far to the front. Nothing ist known about the characteristics of this slug, which, I think, was marketed in 1950/51. It was soon replaced by an improved version, announced in 1953, which remained with us from 1956 to 1964. Still, there is little information available today. It had six straight guide ribs, and a conical hollow on the inside. The felt wad was also missing, as above.

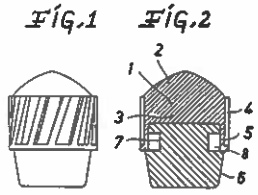
Another make, the Treffer, comes from the VEB Sprengstoffwerk, Schönebeck (East Germany) and externally resembles the Rottweil, but has different dimensions and a stabilizer in light-coloured plastic (Figs. 19 and 20).

Eyeing this development one cannot but feel that the chapter on shotgun slugs has drawn to a close in Germany. Probably owing both to commercial and technical reasons.

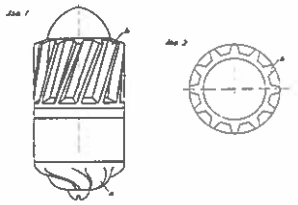
In view of the great differences in shotgun barrels, it is impossible to create a slug that will do equally well in all. Technicians are happy when a load performs reasonably well in most shotguns, and overjoyed when it performs fantastically well in just a few. Brenneke had a fortunate hand, and introduced a very straightforward design which has outlived its competitors. Without a doubt it would be possible to improve on today's slugs if the designs were subjected to a more scientific approach. But the salient point is that enough slugs are not sold to make such an undertaking profitable.

Patents of the last 15 years deal more with modifications of old systems than with new designs. In 1957 Boroviczeny proposed a two-stage slug (Fig. 16); in 1954 Brenneke offered a slug with an improved base for rotation (Fig. 17); DNG-Troisdorf came up with a slug with a brass core (Fig. 18); and the Brenneke successors patented 9 different versions of wadding to replace the felt wads. However, only a slug with genuine improvements can hope for commercial success.

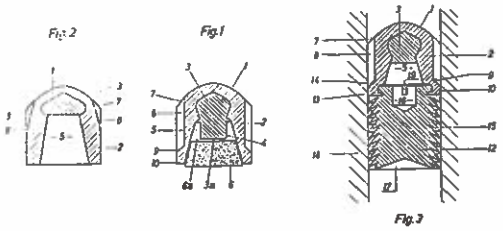
Let us now look at developments in other countries. In America Remington and Winchester have been producing the Foster slug of 1932 since about



16 *The Boroviczenty two-part slug*



17 *Brenneke special rotation slug*



18 *The DNG with brass core*

19 *From left to right: Balle Blondeau, Balle Point Fix (both available in France), cat-head with screwed on plug, the stop slug (the two last mentioned are discontinued), and the Treffer (East Germany)*

20 *From left to right: Balle Blondeau, Balle Point Fix, the FN Brenneke, the Foster Brenneke (Remington), the Treffer*

1936 (Fig. 20), which was patented in 1947 after minor changes. The slug itself is shaped like a thimble, and on the outside has slanting guide ribs. In other words it is similar to Bougnet. Prior to the Foster slug during the 1930s, it is said the Americans only used ball. This is surprising when one consides the standard of development in Germany at that time.

The Americans now import the Brenneke, and there is a number of "self-mades" available. The Foster is also loaded by Eley, and an improved version is marketed by Canadian Industries Ltd (CIL). Both the English and Canadian versions are available in the States. For re-loaders there is a hollow-point Foster (Meyer slug) and a Brenneke imitation from Vitt, which was patented in 1965. So, as you see, there is nothing revolutionary in America.

A real surprise, however, was the unconventional design by Roland Gilbert Auguste Blondeau, a Frenchman who introduced a steel slug in 1950. His invention, called the "Balle Blondeau," looks like a thread spool (Fig. 19, left) and is turned from solid steel. Only the two outside guides are of soft lead. Tests show that its accuracy can be compared to that of the Brenneke. In some cases the "Balle Blondeau" was far superior. Alongside a German and a French Brenneke (with steel tip), Blondeau managed to climb to the top of the French success ladder within a very short time. The effectiveness of this non-deforming slug in the body of deer and other animals is not known to the author. Perhaps the Blondeau will be marketed in Germany before long.

No other slug novelties are known to have come from either England, Belgium, Spain or Italy.

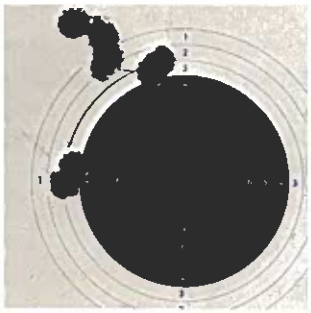
Accuracy

Shotgun slugs and horrible accuracy are closely related in the minds of most hunters, although very few of them test their weapons carefully. The new drilling, bockbüchsflinte (single shotgun barrel with rifle barrel beneath) is used to shoot one or two Brennekes at a paper target; if the spread is good the marksman thumps himself on the chest, if the spread is bad he shoves the rest of the slugs into an old drawer and claims that his gun was not made for slugs anyway.

But the next time wild pigs run across his vision his shock will have been forgotten, and more likely than not he will blaze away with Brennekes. What wonderful yarns are heard from these sharpshooters, when a pig has been downed, what praise is bestowed on the slug! The mood remains a happy one, as long as one does not inquire about spread, centre of impact, velocity, etc.

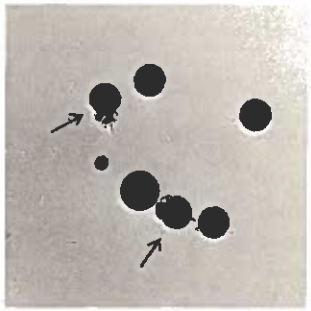
21 *Grouping of the right barrel of a Sauer drilling with Rottweil Brenneke slugs, scoped to bull's eye*

a) *35 m, 5 shots*



b) *50 m, 5 shots*

22 *Grouping of the right barrel of a Sauer drilling with Balle Blondeau*

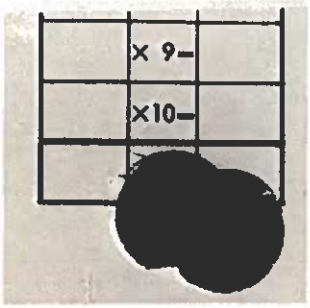


a) *at 35 m with rifle bullet to check point of impact*

b) *at 50 m*

23 *Typical keyholing*

a) *Brenneke at 50 m*



b) *Balle Blondeau at 35 m*

No one would dream of sighting in a rifle with the same degree of shallowness. Here it is a matter of course that adjustments are made to the scope, or to the iron sights. When firing slugs from shotguns immediate success is taken for granted, or the slug is not worth the metal it has been made from. We must all bear in mind that most shotguns have more than one barrel, each of which can react differently, and as there are no standards for slug accuracy, everyone must decide for himself whether his gun is producing adequate results. Altering the barrels is a very delicate matter indeed, and should perhaps be best left alone. Barrels that perform well with shot, do not necessarily perform equally well with slugs. If we limit ourselves to guns that are good slug performers, a dispersion of up to 15 cm (5 shots) at 50 m is about average. However, some guns deliver a spread of under 25 cm at 100 m, a feat I have witnessed myself. But the average gun will fire 25 – 30 cm groupings at 80 m. Beyond this distance accuracy can no longer be guaranteed. It is obvious that a gun giving a 20 cm spread at 35 m is almost useless at 50 m.

In Germany each make or gauge has just one load, so we are obliged to find the best barrel for the slug we use. That is why I dwell on barrel performance.

To test dispersion 5 shot groups should be fired at ranges of 35, 50 and 80 m. Flyers are a bad omen, if they come up one behind the other. My Sauer drilling spat out 20 – 40 per cent flyers, depending on make and load. Figs. 21 and 22 show groupings from the right barrel, arrows mark the flyers. Fig. 23 shows the keyholing effect of a tumbling slug. The slug hits the target at an angle that can be estimated by measuring the length of the tear. The highest measured during this test were angles of 30–40°. The normal degree of tumble is around 10°. Tumbling slugs, of course, have less flesh penetration when hunting animals. Here is yet another reason to limit range when hunting with slugs. The illustrations show that one target alone can be very deceptive.

When comparing the data in Table I (from W. Lampel, Handbuch für Jäger und Schützen, 1942) and the dispersion in my illustrations, it will be clear to all that some of the slugs have greatly deviated from the average point of impact. However, in the centre the points of impact seem to be more regular. In Fig. 21 the right barrel of my drilling shot 4 cm high at 35 m, and 8 cm high at 50 m, which comes close to the table rating for a gun sighted in at 100 m.

The German hunter's magazines have often dealt with the on-body performance of these slugs in deer and other animals. But the commentaries are so contradictory that it is not worth while to give positive or negative examples.

An interesting article on slug effectiveness on white-tailed deer appeared in Gun Digest in 1970. In some of the American states whitetails can only be hunted with rifled slugs. The hunters in these areas possess great practical experience, which is interesting for us, too. According to this article, knock-down power is not as phenomenal as one might expect.

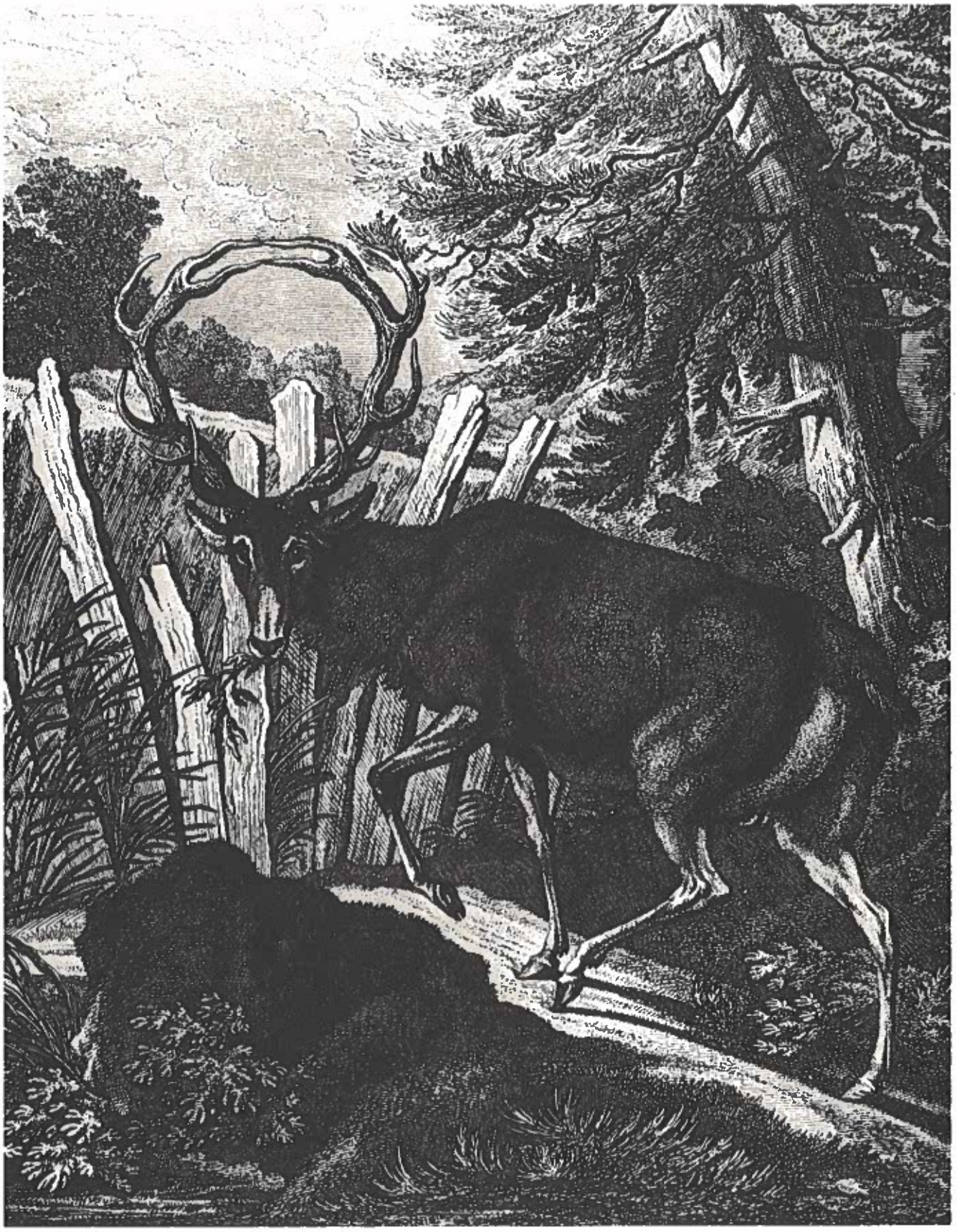
When one considers performance of the factory slug loads, these 70 years of development are very disapointing indeed.

Performance, generally speaking, can only be improved when the sportsman can re-load himself, or has an expert gunsmith on hand who can change the barrel to the load. One might say that von Witzleben, Brenneke and Stendebach had gotten this far 70 years ago!

Reference to Shotgun Shell Slug Chart appearing in DWJ

Shotgun Shell Slug		Slug Weight ounces	Velocity in fps				Energy in ft.lbs.				Trajectory height in inches when zeroed in at			
			V/0	V/25	V/50	V/100	E/0	E/25	E/50	E/100	25 m	50 m	75 m	100 m
Rottweil Waidmannsheil	12 ga.	1.123	1591	1362	1181	951	2756	2018	1519	984	+1.06 –.28 +.24	+2.7 O +1.02	+3.03 –1.54 O	O –5.43 –3.39
Rottweil Waidmannsheil	16 ga.	0.978	1509	1280	1099	876	2163	1555	1143	731	–0.03 +0.59	O +1.22	–1.85 O	–6.54 –4.06
Rottweil Waidmannsheil	20 ga.	0.833	1513	1273	1086	860	1852	1309	955	600	+1.57	+3.31	+3.27	O

Explanation: V/0 = MV, E/0 = ME, V/50 = velocity at 50 metres – and so on.



Horst Schankliss

The Gun Collection in

"At Erbach in Odenwald there is nought to eat, and the weather chills the bone!"

This lugubrious piece of verse was not found written in the visitors' book of an Erbach boarding-house, it was written in chalk on the door of a house after a horde of Croatians had ravaged this defenseless area of the town in 1622. The Croatians, indignant at the sort of hospitality they were receiving, started plundering and killing anyone who crossed their paths. Count Ludwig, a knight, tried to save his subjects from being murdered by presenting the grim-faced Croatians with a letter of safe conduct signed by Tilly, a famous German general. But this in no way impressed them. It will never be known whether the Croatians lacked respect for the German Emperor's general, or whether they were unable to read. Count Ludwig's main concern must have been how to get himself safely to his castle! The Croatians hurled imprecations at the townspeople, and attacked with even greater savagery. But then their luck turned: five of the invaders died on the battlefield, the rest of them retreated. However, these gentlemen did manage to leave the pithy quotation for the benefit of posterity or feudal tourism.

The inhabitants of Erbach, it must be said, just could not care less what the Croatians scrawled. They had lost their cattle and many of their relatives; Count Ludwig himself mourned the loss of valuable Swiss cows and three flocks of sheep.

Visitors to Erbach today are usually well-behaved. They do not cause an uproar, rape the pretty young maidens or embellish the doors of the hotels with graffiti. Tourists go to Erbach either to convalesce at the spa or to stretch their legs in the vast courtyard of the castle. The world-famous ivory museum no longer exists; still, the castle houses a number of beautiful objets d'art, and is frequently visited by connoisseurs. The "Roman Room" shows marble sculptures in their original condition when found in

Photos by Weller and Schankliss.
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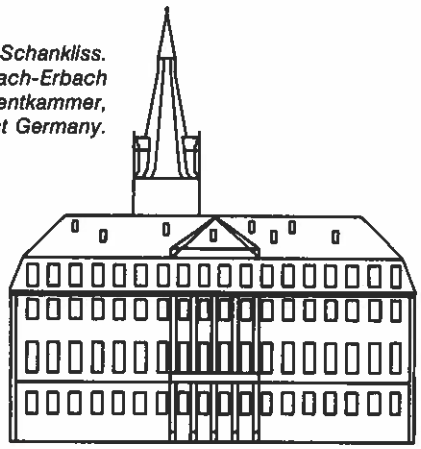
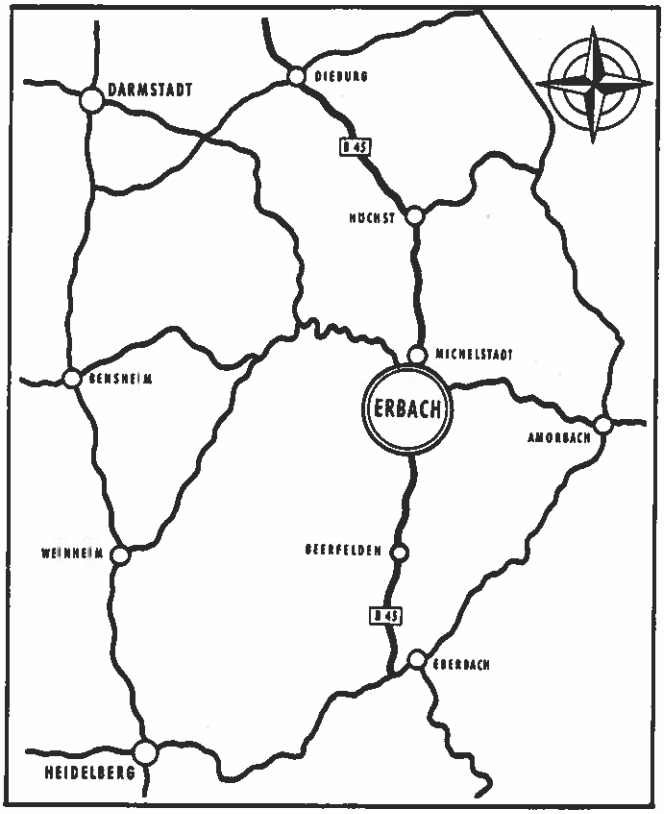


Erbach Castle, Odenwald, Germany

Cavalry parade helmet, mail, swords and battle axes in the "Rittersaal".

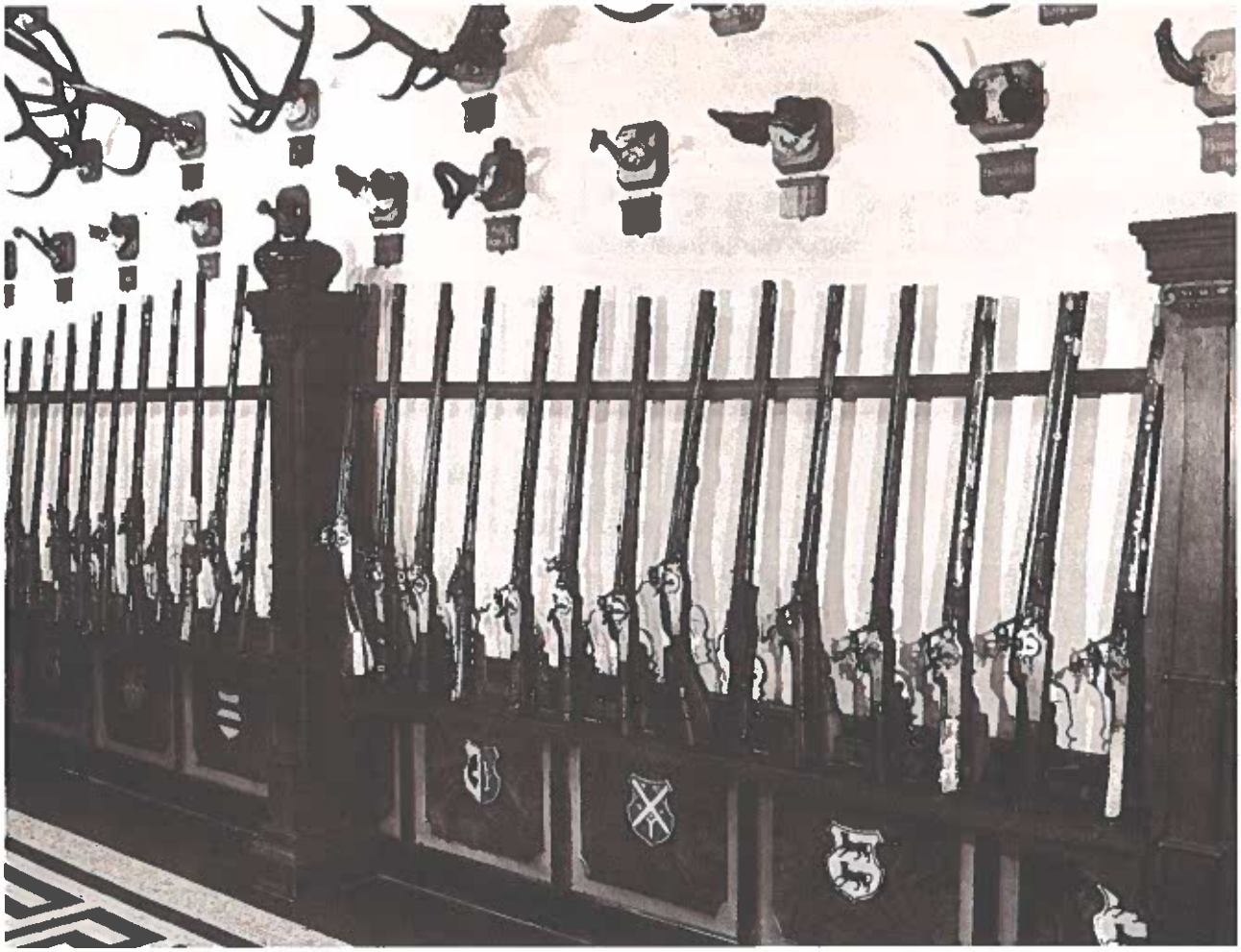


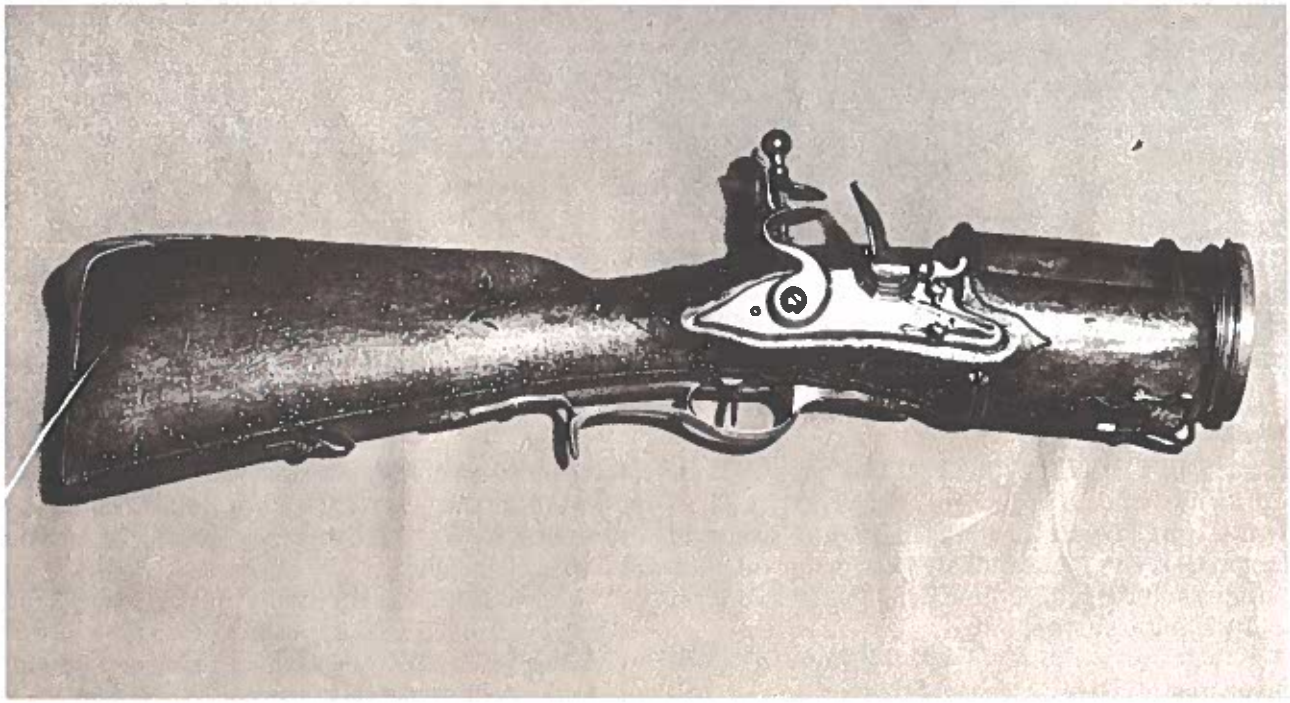
This blow-up shows Erbach, and the best way of getting there by car.

the earth in Italy – the "Reichsindex" now forbids their being sold abroad. The Rittersaal (hall of knights) can today be viewed as the "Gun Museum of German Chivalry," additionally, the colourful glass paintings and the high Gothic windows are works of art of the highest standard.

For the hunter and admirer of antique weapons Erbach Castle is truly a treasure trove: there you can see what is probably Europe's largest collection of hunting trophies, apart from a collection of arms representing an unbroken line of development in hunters' guns, etc.

This collection is the doing of one man, Count Franz I who lived from 1754–1823. To appreciate the significance of this collection the reader should first be told something about this remarkable person; for

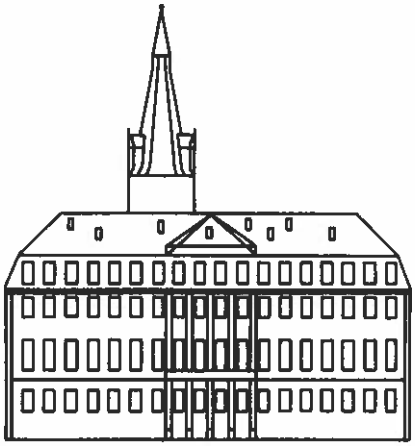


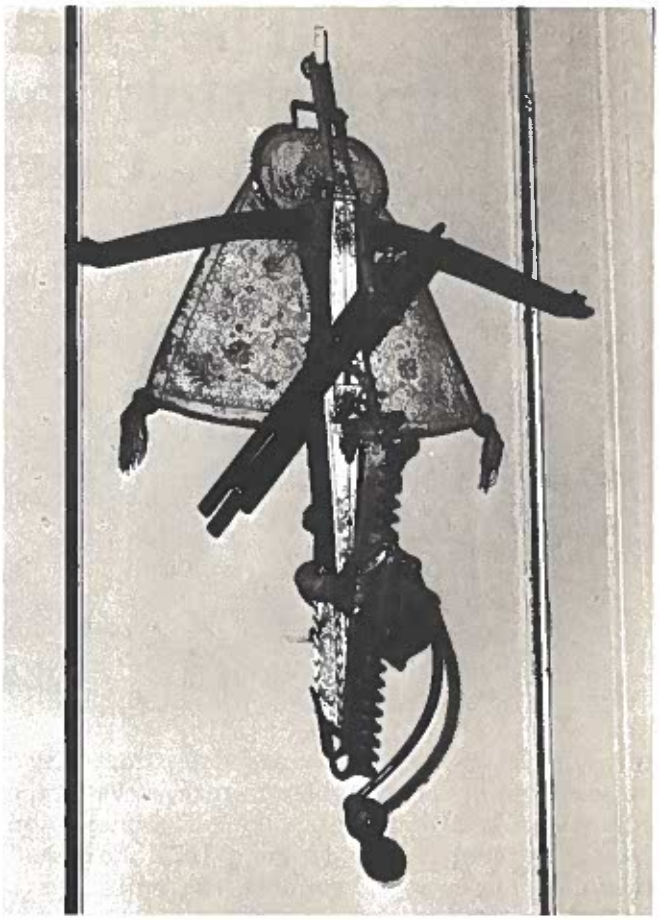


Top left: A trellis-work of wheel-locks in the reception hall, frowned on by a row of "anomaly" antlers.

Bottom left: A flintlock that may be considered the precursor of the granade launcher. Dated c. 1700, the 14.3 cm barrel of 7 cm calibre was loaded with an iron ball filled with gun-powder that was ignited with a fuse. This gun not a success, for its hefty recoil often broke the marksman's collar-bone.

Top right: German crossbow with quarrel and hunter's bag.





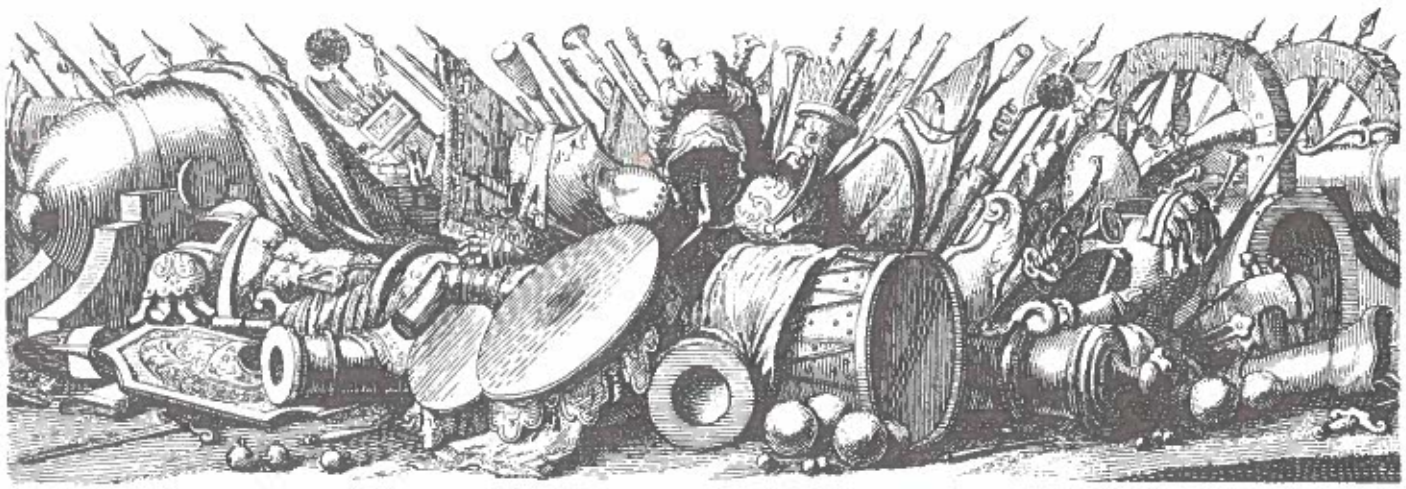
his various activities brought about many fundamental changes in this part of the Odenwald. Franz I was the last sovereign ruler of the then County of Erbach. When he turned 13 his father died and he grew up in the sheltered care of his very young mother. Here must be the key to his peace-loving character, to his energy to improve his surroundings; for unlike many of his contemporaries there was nothing bellicose in his nature.

When he was 15 his mother arranged that he visit the important places in Europe, accompanied by a tutor. He went to Lausanne, Paris, Strasbourg, and he called on virtually all the principalities in Germany and the rest of Europa. These journeys broadened his mental horizon, and he learned many new things that would benefit his own Odenwald district. During these years of wandering through Europe he began to collect objets d'art, the basis of today's Erbach collection. At 21 he was in charge of his county and immediately proceeded to carry out badly needed reforms. The peasants, who were facing a crisis, received gratis distributions of clover seed and fertilizers. Stock-farming was energetically furthered, and model farming plants instructed the peasantry in the latest methods. New roads were built and commerce began to flourish afresh, once preferential tariffs and other trade agreements had been reached with the neighbouring states. Even a savings bank and loan office were founded, which offered the peasants very attractive interest rates. Count Franz I built a linen and cotton factory, and encouraged the building industry which had been paralyzed by an interdict.

However, the most important branch of industrialization was ivory carving, a handicraft that made Erbach famous throughout the world. Indeed, ivory carving is an active industry in Erbach even today. Franz I learned the art of carving ivory in Campania (Italy) and in Vienna (Austria); not only could he set a personal example, he could also expertly advise on the quality of raw material and on the type of machinery required.

The count's permanent concern was that his subjects should develop more understanding of worldly matters. He raised the salaries of the teachers and of

The Gun Collection in Erbach Castle, Odenwald, Germany

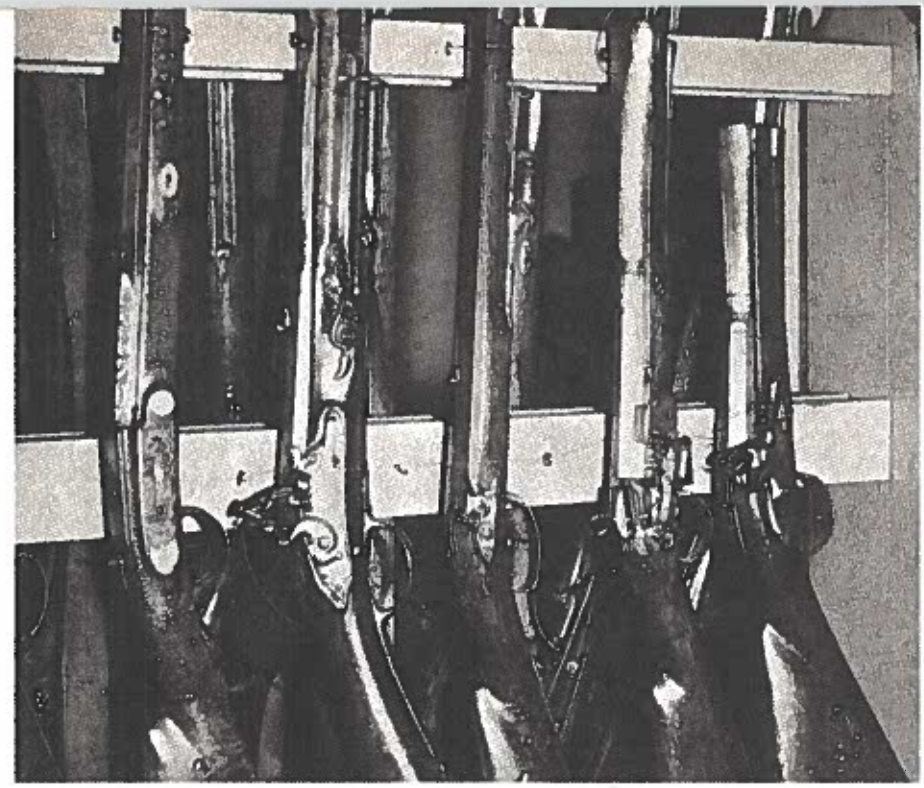


the churchmen, and hence managed to attract skilled personnel to his county, who, in turn, elevated the educational level of the peasantry. An "alimentation fund" was set up in 1786, for the welfare and education of poor or orphaned children. His aspirations to raise the level of education in the Odenwald district took Count Franz I to Italy in 1791, where he obtained many beautiful works of art for the "Roman Room" of his castle.

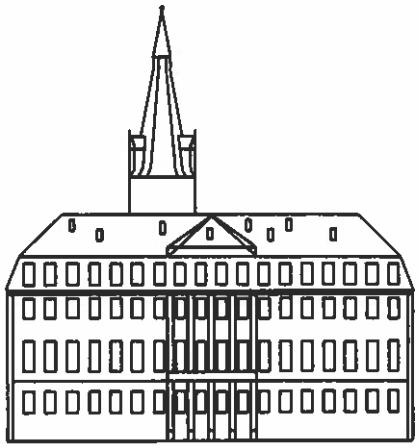
Count Franz I was a passionate huntsman and created Eulbach, a large game preserve a few kilometres from Erbach. We owe thanks to this game preserve for many of the super trophies that can be admired today in the "Hirschgalerie" (gallery of stags). Discarded antlers picked up 200 years ago weigh over 7 kg – the stags in those days were as big as horses, some as big as oxen! The heaviest of the 70 giant antlers on display flaunts 32 tines, weighs 32 (German) pounds, and the animal's venison must have weighed 8–10 hundredweight! This stag of stags was shot near Nuremberg in 1650.

Erbach displays abaut 600 horns of other deer species, including many anomalies and so-called "wig-heads." These horns line the stairs leading up to the Hall of Stags, and if you look carefully you will spy a hare, also horned!

Close-up of really splendid flintlocks. Eye-openers not only for the fantastic marquetry work on the stocks, but also for their artistic lockwork. ▶

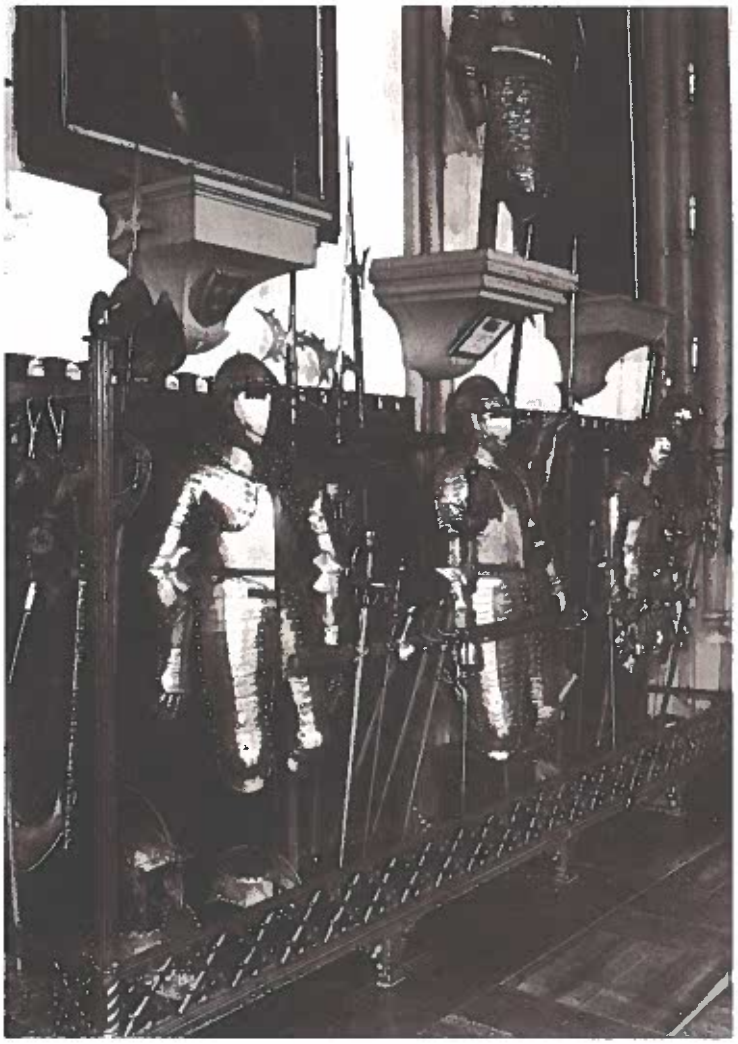


◀ *Blunderbusses whose barrels are filled with bits of lead, iron and other niceties.*



▼ *A parade of flintlocks in the "Gewehrkammer."*

The "Rittersaal" showing a suit of armour believed to have been worn by Captain Georg von Waldburg. However, this piece is of a later date and was probably made in the mid 17th century. ▶



On entering the reception hall the gun lover cannot miss the long rows of sporting guns, and his heart will beat louder when he finds himself in the "Gewehrkammer" (gun chamber).

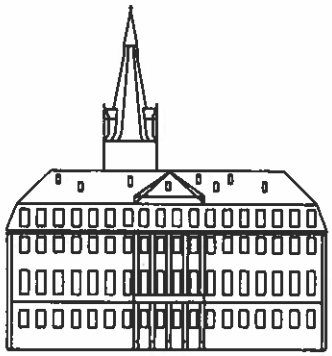
Here you can trace the history of firearms all the way back to its origin. The most ancient piece is a hakenbuchse (hook gun), dated 1530. Considering the number of interesting weapons on display, it is simply not possible to describe them all in this one article. There are matchlocks, an air gun of 1790 with a steel piston, an air gun that has been camouflaged as a wheel-lock, Kuchenreuter pistols and works by Freund, the celebrated gunsmith of Furstenau. The collection is truly comprehensive and for the visitor it is gratifyng to know that the guides possess a wealth of information, and will readily answer all questions.

Opposite the "Gewehrkammer" is the "Rittersaal," which takes up one whole wing of the castle. This is where the suits of armour stand stiffly on parade, together with a host of offensive and defensive weapons. You can see the Leining armour of 1525, a Burgundian ducal armour of 1520, a complete suit of field armour of c. 1500, a half field armour of the first part of the 17th century, which is believed to have been worn by King Gustav Adolf of Sweden. It was purchased from the arsenal in Nuremberg and the breastplate is embossed with the Swedish royal coat of arms.

The most valuable exhibit of the "Rittersaal" is a Milanese show-piece saddle of c. 1600. It was bequeathed to the Erbach collection by the reigning Count of Ortenburg. The underside of this saddle is lined with velvet, the rear side of the cantle is inlaid with sheet-steel and framed with gold-plated strips of copper. Chased in the sheet-steel are scenes from a cavalry charge, but the way the chasing was actually executed is unknown to the present-day experts.

The Erbach collection also houses a number of other items of interest to the hunter: powder flasks, hunters' bags, accessories, pottery from Faenza (Italy), trophy cups, magnificently chiselled crossbows, wild-pig pikes, hunting-knives and even dog collars. The "Gewehrkammer"contains a model whereby

▲ *The "Ortenburg Saddle," probably the most valuable exhibit in the Erbach collection. Scenes from a cavalry charge on the rear side of the cantle.*



stag hunting of the 18th century can be studied, and a string of Oriental guns, too.

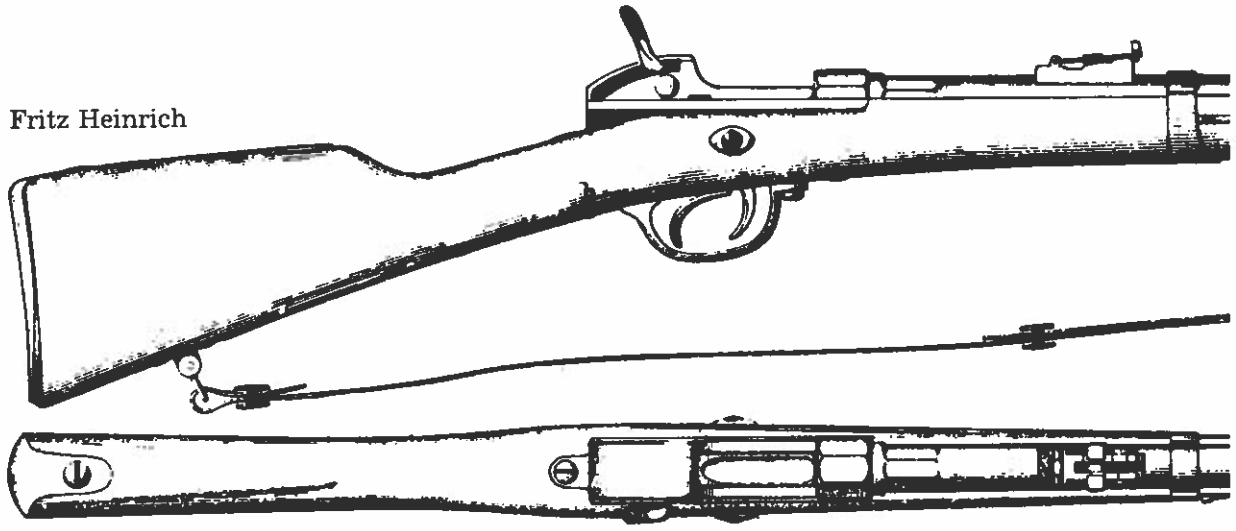
A guided tour of the collection takes about one and a half hours. For the connoisseur, of course, this is on the fast side, and it breaks his heart to hear the local bus guide shouting: "Hurry up you lot! We've still got another castle to look at!" Take your time, it's really worth your while.

Those of you who are exploring Germany by car are recommended to drive on to Beerfelden where an outdoor organization has laid on enough car parking space to accommodate our visitors, i. e. after sightseeing the Erbach castle. Although walking along the countryside seems to be an unpopular pastime with many of our American friends, here's an opportunity to breathe in the rich, fresh air of the Odenwald forest. Conspicuous signs show the routes of every footpath, and, in time, each footpath leads back to the car-park, so there is no worry of getting lost.

Half armours believed to have been worn by Albrecht Alcibiades and King Gustav Adolf of Sweden respectively. Both suits were purchased from the Nuremberg arsenal.

▼

Fritz Heinrich



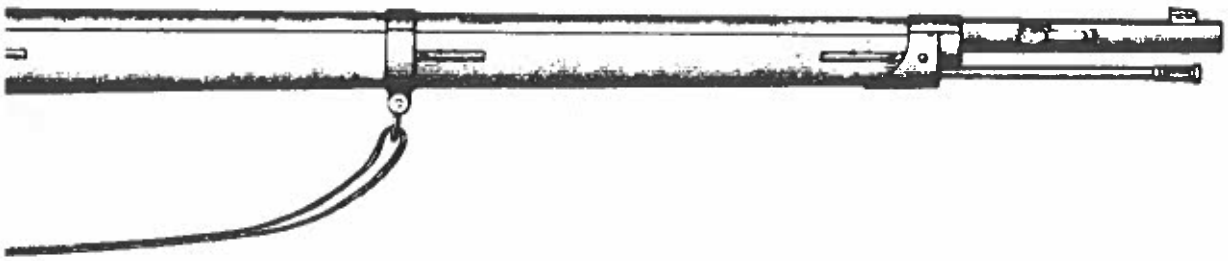
The Bavarian Werder Rifle, Model 1869

Johann Ludwig Werder, technical director of the Cramer-Klett engineering works in Nuremberg (today MAN), offered in October, 1867, a breech loader to the Royal Gun Factory in Amberg, the tests of which proved very favourable. On the strength of this the War Department decided to send Major-General von Steinle, head of the Bavarian Arms Commission, and three assistants, to Amberg to discuss the possibility of having the new breech loader adopted by the army. Rifles competing in the trials were Werder, Werndl, Peabody, Chassepot, Norris and Vetterli. However, only the Werder and Werndl were considered after Podewills had introduced a very suitable cartridge for the Werder rifle by combining the Boxer iron base head with an expanding copper case.

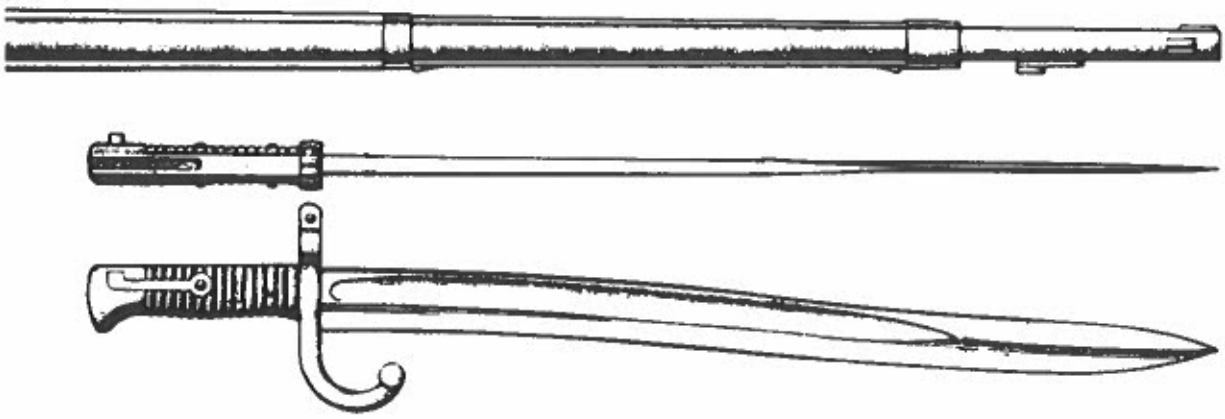
Equipped with this cartridge the Werder rifle demonstrated those excellent qualities which had been attributed to it, and the Arms Commission deemed it suitable for military purposes. For all that, a few of the members of the Arms Commission cast doubt on the weapon's durability and fitness for war service, for the pivoting block system of this rifle had not proved itself under really adverse conditions. Thereupon, the War Department requested the patentees, Werder and Werndl, to supply rifles and action parts for extensive field tests. Troop trials were conducted in the winter of 1868/69. The Werndl rim fire rifles were issued to the Infanterie-Leibregiment (Prince's Own) in Munich, whereas the Werders went to four infantry and four jaeger battalions at eight different garrisons.

A number of Werder rifles were subjected to 2000, and one to 5000 rounds at the factory. Although a part of the ammunition used was not designed for the Werder, the rifles continued to function perfectly.

The troops left the rifles lying around in the open air for weeks on end, left them dirty and unoiled, poured dust and sand into the actions, applied corroding agents, threw them into water and used cartridges that had undergone minor changes through filing. That the Werder was still fit for service after such gruelling tests may be put down to the fact that this rifle's action had few friction surfaces, few moving parts and enough dead space to collect dirt without seizing up. Lock parts were interchangeable, too.



1 *The Werder infantry rifle Mod. 1869 1/4 scale*



The Werder only used 10 parts for opening and closing the action, for ejecting and igniting!

Rate of fire: The average soldier could fire off 10 aimed shots a minute, loading from his pocket; the above-average 14 to 15. Skilled riflemen could fire from 20 to 24 shots a minute. When a target was set up measuring 9 x 4 feet at 200 paces, four marksmen managed to make contact 36 times with 36 shots viz:–

the first within 2 min. 35 sec.
the second within 2 min. 15 sec.
the third within 2 min. 10 sec.
the fourth within 2 min. 6 sec.

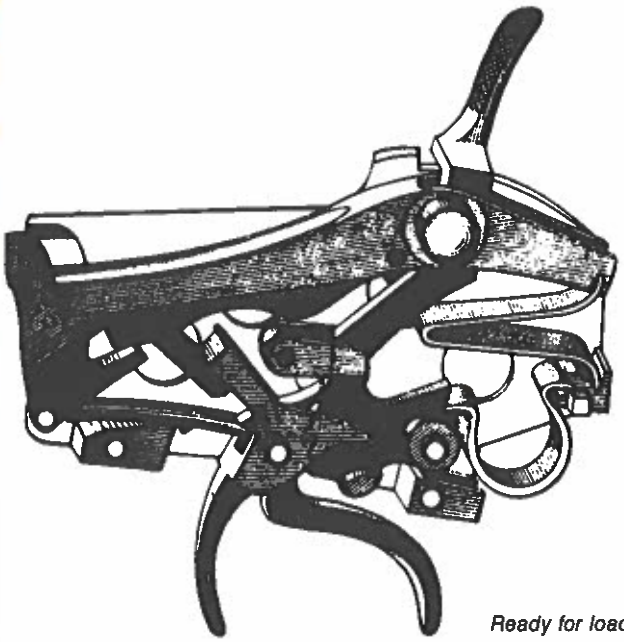
The results of penetration tests in soft wood were as follows:–

17.5 cm at 200 paces
13.5 cm at 400 paces
11.6 cm at 600 paces
9.1 cm at 800 paces
7.8 cm at 1000 paces

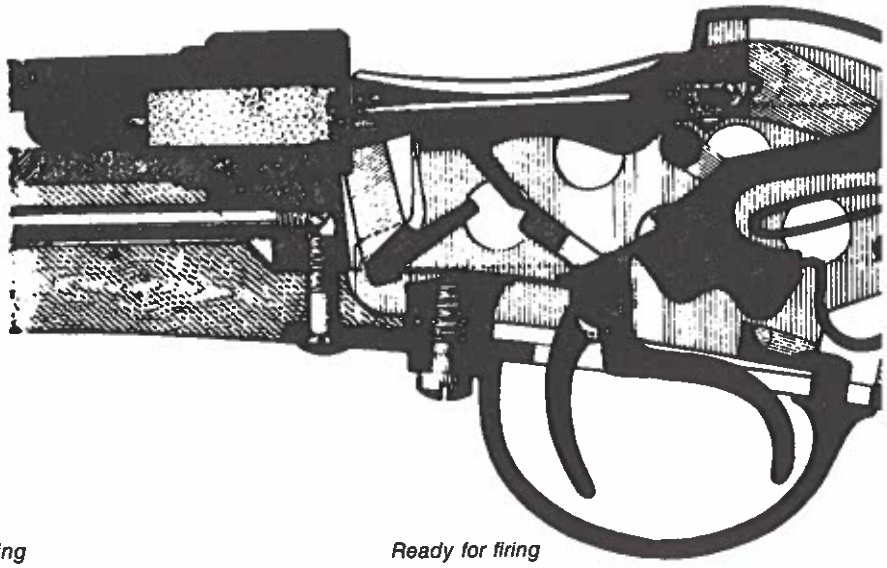
Of the 800 Werder rifles that were tested with 161,496 cartridges only 150 breakages occurred, viz: 44 extractors, 25 firing-pin springs, 10 action springs, 7 hammers, 15 extractor springs, 24 firing pins and 18 coil springs; 7 extractors were bent. No damage at all occurred to the main elements of the action. It must be borne in mind that the initial 800 rifles were the first of their kind, that the parts were largely hand made, and that copper cartridges were used during the trials, not those made of brass which appeared later and were much superior.

Based on experience gathered at the trials, the Werder was re-introduced with a strengthened extractor, a new hammer thumbpiece and improved springs, and was then adopted by the infantry and jaeger battalions of Bavaria on April 18, 1869. On July 1, 1869, the War Department decided to equip the cavalry regiments with a Werder carbine and pistol; after Major-General von Tausch had settled all questions concerning design of the carbine and how it should be carried on the horse, etc. Once the Werder rifle had successfully concluded its trials, the director of the Royal Gun Factory was approached and empowered to start mass production of the new weapons and to find reliable companies at home and

Four phases of the Werder action, shown in 2/3 scale.



Ready for loading



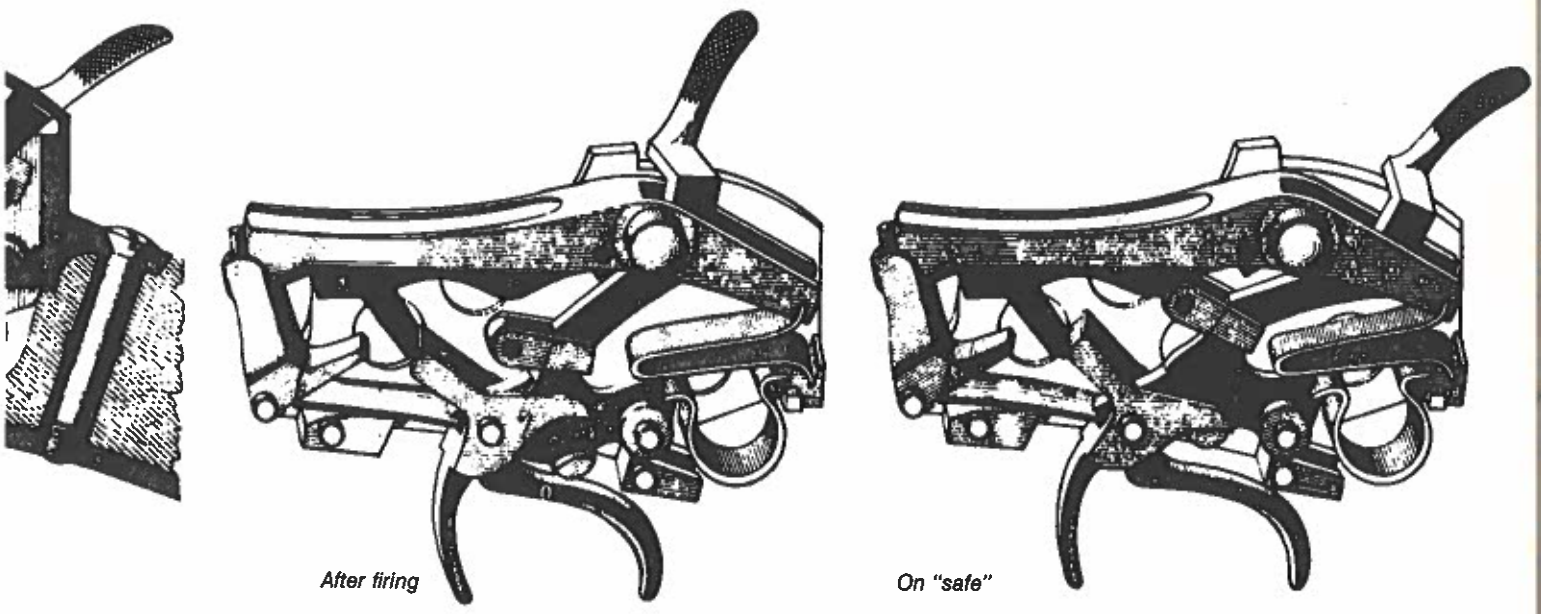
Ready for firing

abroad to share the burden of manufacture. As the Royal Gun Factory of Bavaria had not the capacity to set up new machines for additional army orders, it was obliged to collaborate with private industry to meet the required production figures. Owing to this situation, an order for 100,000 actions, partly complete, partly without the action housing, was given to private companies. The chief participants being: Cramer-Klett in Nuremberg, Maschinenfabrik Augsburg, Landes in Munich, Machinenfabrik Riedinger and Haar in Augsburg.

Moreover, a consortium in Suhl consisting of Schiller, Haenel, Spangenberg and Sauer was commissioned with the delivery of 20,000 finished M 69 rifles. The delivery of the yataghans (Turkish scimitar with a double-curved blade) was partly entrusted to the same consortium, partly to the firms of Koppel and Weyersberg in Solingen. Francotte in Liege (Belgium) and the Maschinenfabrik Landes in Munich each delivered 4000 carbines, Mod. 69. The gunsmiths Greis in Munich and Schönamsgruber in Nuremberg each delivered 2000 pistols, Mod. 69. Francotte in Liege also produced the Werder constabulary rifle (for carbine cartridge) with spike bayonet. The Royal Gun Factory of Bavaria processed the semi-finished stocks and barrels delivered by Berger & Comp. in Witten, König & Rennert in Annen, Simson & Luck and Schlegelmilch in Suhl, as well as fitting lock and orther parts together to make up the finished rifles.

As the iron base head of the cartridge for the M 69 often tore loose, the army began to wonder whether it might not be feasible to adapt the otherwise standard M/71 cartridge to the Werder rifle. After extensive testing at the Military Gun Academy it was decided on June 2, 1875, to adapt the Werder 69 to chamber the M/71 cartridge. Beginning in December, 1875, 10,000 rifles a month were re-chambered and re-sighted. When the work was completed in October, 1876, the converted Werder was designated the M 71. A total of 124,540 rifles were subjected to these changes. However, the stronger M/71 cartridge did cause trouble for the locking mechanism. The War Department approached the directors of the Royal Gun Factory on March 17, 1875, with the consent of the Military Gun Academy, to request them to suggest improvements for future rifles, bearing in mind the experience gained with the M 69 and the M/71 cartridge.

The Royal Gun Factory was commissioned to redesign the M 69 along the lines of the M 71 rifle, but with stronger extractor. The walls of the breechblock on both sides of the extractor were reduced by 0.20 to 0.25 mm, at least where the breechblock moves between the extractor arms. The lock plates received deeper-lying axles, and were adjusted in thickness. Once the new version had been approved on July 21, 1875, production of 25,000 pieces began. Private industry was again employed, the Austrian Waffenfabrikgesellschaft in Steyr tak-



After firing *On "safe"*

ing the lion's share of the orders. These improved rifles remained with the 2nd Bavarian Army Corps until 1882.

The Werder rifle is an ingenious modification of the American Peabody tilting block system, without the under-lever release. A design that proved itself admirably in the 1870/71 Franco-German war. The block, housing the firing pin, is pivoted for loading by actuating the forward reversed trigger. A cartridge slides down the tilted concave face of the outside block into the chamber with ease. An arm and roller attached to the hammer mechanism closes the block or breechblock when the hammer is cocked and returns the firing pin to its home position. Over the hammer spring is the V-shaped breechblock spring that causes the breechblock, when opened, to smartly strike the lip of the extractor. Extractor and trigger share a wide, flat spring. The firing trigger and the breechblock trigger are mounted on one axle. The breechblock is held in its closed position, when the hammer with its roller arm has dropped, by the reversed trigger extension.

Breechblock, hammer, extractor, triggers, etc. are sandwiched between the two side walls of the action, the left of which is removable, functioning as a dust cap. This self-contained unit slides into an opening of the one-piece stock.

The barrel is of cast steel. The working parts, according to what is required of them, are of various materials and degrees of hardness. The walls of the action, the breechblock and the triggers are of fine-grained iron; the firing pin, its guide, the extractor, the roller and pin, the four springs and the hammer are of cold-hammered steel. All parts housed within the action are higly polished to enable detection of flaws. Matching serial numbers are stamped on the left barrel joint, on the left wall of the action, on the right side of the butt, inside the trigger guard, and on the bayonet guard of the yataghan. The main side plates, the breechblock, the hammer, the reversed trigger and the extractor have additional matching numbers, apart from the KG factory stamping. On the top part of the butt cap and on the bayonet guard, on the side opposite the catch spring, are the initials of the regiments and battalions that used the weapons.

For example:
LR = Infantry-Leibregiment,
3 = 3rd Kompanie
7R = 7th Infanterieregiment
1 = 1st Kompanie
4J = 4th Jägerbataillon,
2 = 2nd Kompanie

On the yataghan:
2.R 12 = 2nd Infanterieregiment,
12th Kompanie

The Werder action was very simple and rapid to

operate. To open the breech and eject the spent case slight pressure on the reversed trigger is exerted. On the other hand, to cock the gun the hammer is drawn back after a new cartridge has been slipped into the chamber, the breechblock being automatically elevated.

The M 69 Safety

The safety is applied by lifting it out of its detent, by letting the hammer down to half cock and recocking it until the safety catch engages with its notch and the breechblock falls a short distance. In this safe position the breechblock rests only on the roller arm, the hammer is semi-cocked, the extractor and firing-pin springs are only partially tensioned, the coil and double spring are virtually at rest, the extractor claws remain in their recess, the locking prop of the reversed trigger is disengaged and the nose of the reversed trigger extension lies on the lug of the bottom part of the hammer assembly. Even if the rifle were to accidentally fall, the hammer would not make contact with the firing pin, since any jarring of the action when in the safe position causes the breechblock to completely drop, for when the hammer goes forward the roller arm can no longer support the breechblock.

General data M 69 / M 71

Calibre 11m
Length of rifle without bayonet 1308 mm
Length with bayonet 1786 mm
Length of barrel 889 mm
Length of twist 915 mm
Number of grooves 4
Width of lands 4.4 mm
Width of grooves 4.2 mm
Depth of grooves 0.26 mm
Weight without bayonet 4270 g
with bayonet 5000 g
Lowest rear sight graduation 216 m
Highest rear sight graduation 864 m
Sight graduation on Model 71 250–1600 m

Ammunition

Hiram S. Berdan, an American general, offered his rifle (Mod. II) to the Bavarian army at about the same time Werder offered his rifle. Although the Berdan II was rejected, its drawn brass cartridge and new type primer were accepted for the Werder rifle. The ammunition used in the M 69 consisted of live rounds, blanks and dummies.

The live cartridge: The case weighs 9.32 g and measures 49.69 mm. Complete cartridge weighs 36 g and measures 64.6 mm. Bullet: Ogival, soft lead, three grooves and a lubrication cavity; length 24.32 mm, weight 21.96 g, diameter 11.51 mm; load =4.3 g new rifle powder (76 parts saltpeter, 10 parts sulfur, 14 parts charcoal).

The blank cartridge: Case is identical with that of the live round, but has a groove 9 mm from the base, the base itself being marked in red. It was normal procedure to use cases that were unsuitable for making up live rounds. The primers, too, were selected from the so-called seconds. Crushed blotting paper was pressed into the case to keep the powder in place, a part of which acted as a stopper, protruding slightly over the neck of the case.

The dummy cartridge: Case is approx. 4 mm shorter than that of the live and blank cartridges, and were taken not from second but from third-rate stock. The primer is unfilled and the case contains a piece of white beech which is shaped as a bullet at the top end.

The pistol and carbine cartridge: The case weighs 8.2 g and measures 35.05 mm. Complete cartridge weighs 32.9 g and measures 49.9 mm. Bullet: Ogival, soft lead, three grooves and a lubrication cavity; length 24.32 mm, weight 21.96 g, diameter 11.51 mm; load =2.5 g new rifle powder (76 parts saltpeter, 10 parts sulfur, 14 parts charcoal).

These Berdan drawn brass cartridges with centre-fire primers were manufacturered for the Werder rifle by H. Uttendörfer in Nuremberg.

Ammunition for the converted M 69 and M 71

The live M 71 cartridge: Breechloading ammunition requires, a) a ductile case that will expand against the wall of the chamber and contract after gas pressure drops to enable extraction; b) sufficient strength to prevent a rupture or the head of the case from being torn off; c) the cartridge must be a perfect fit for the chamber in which it is fired. The M 71 case weighs 12 g and measures 60 mm. Complete cartridge weighs 42 g and measure 76.8 mm. Bullet: Ogival, soft lead, has small cavity at base to take up the crimp of the paper wrapping; weighs 25 g and measures 27.5 mm. Calibre is the same as the bore (11 mm), but expands under the explosion to fill the grooves. The load consisted of 5 g rifle powder M 71

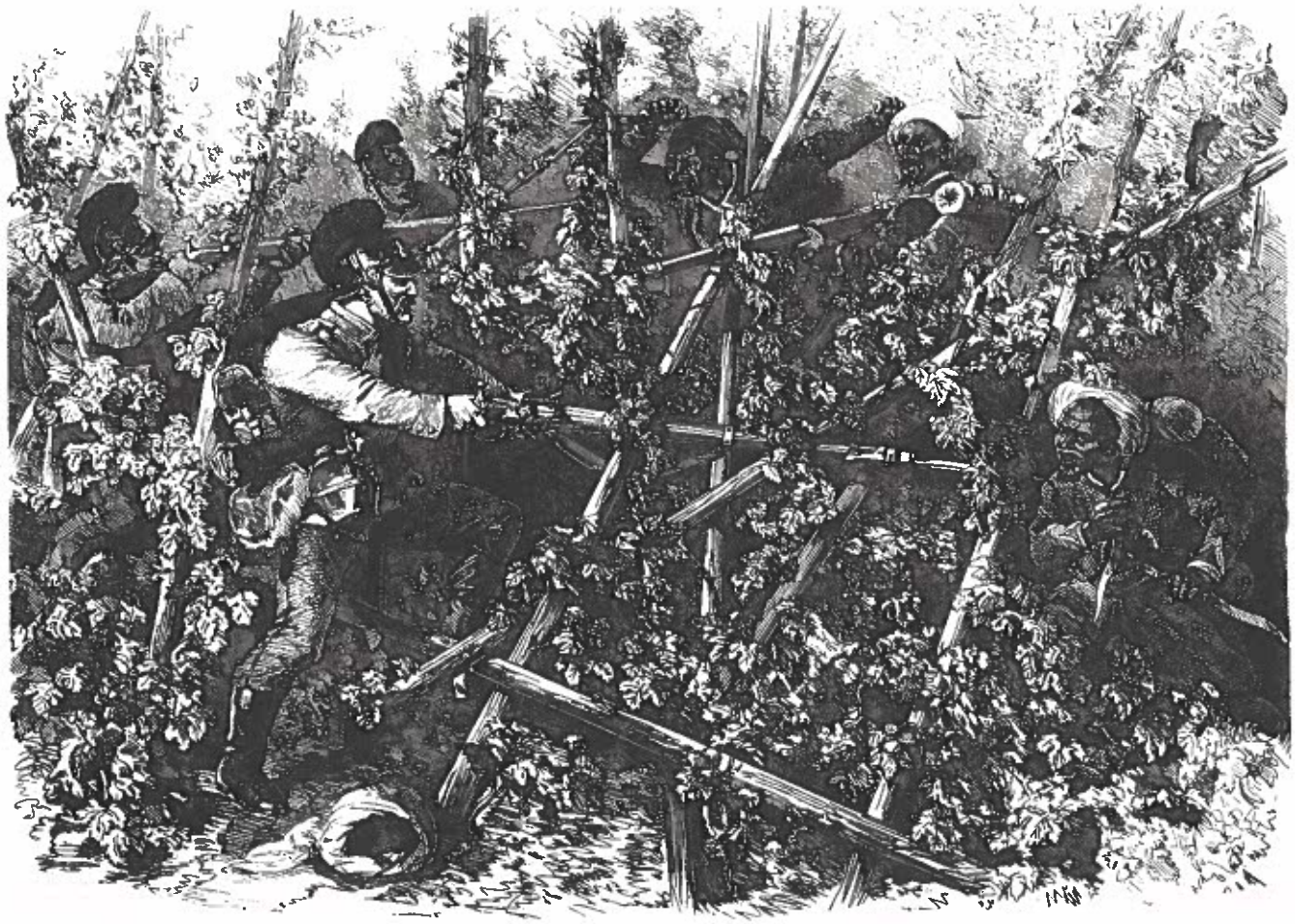
or 4.8 g of English powder from Curtis & Harvey. The wads of wax and cardboard discs separated powder load from bullet and helped keep the barrel clean.

The M 71 blank cartridge: Case is identical with that of the M 71 live round, but has a groove (1.5 x 0.5 mm) 9 mm from the base, the base itself being marked in red. Load consisted of 3.5 g second-rate powder.

The M 71 dummy cartridge: Cases that are not suitable for live or blank rounds are used for dummies. In order to protect the firing pin unfilled primers are soldered into the cups. The case contains a piece of white beech which is shaped as a bullet at the top end.

Now a few details about the designer of this Bavarian army rifle:

Johann Ludwig Werder, born May 17, 1808, in Narva near Petersburg (today Leningrad), went to stay with his uncle in Switzerland when his father died in 1817. There he learned the locksmith trade. After working in Switzerland, Austria and south Germany he went to Nuremberg as a machinist in the Royal Train Workshop. On November 1, 1848, Werder joined the engineering works of Cramer-Klett and became technical director. Ludwig Werder was a gifted inventor. He manufactured orthopedic devices, made a number of inventions in the railroad car industry and in machine and bridge constructions. He designed machine tools for producing nails, materials testing machines and a traction engine. The gun was not his life's work, as was the case with Dreyse, Mauser Browning, etc. Werder also designed special machine tools for the production of his own rifle. He died August 4, 1885, in Nuremberg.



Bavarian infantrists v. Algerians and Zouaves in the hop fields near Weissenburg / France

The Zig Zag Mauser

Martin Behrens

On October 27, 1873, the Royal Württemberg Gun Factory at Oberndorf was to be sold by auction. As expected, only two interested parties turned up to make a bid: Wilhelm and Paul Mauser. The designers of the already well known M 71 infantry rifle had owned a factory at Oberndorf since 1872, the productive capacity of which, however, was too low for large-scale operations.

The Mauser brothers were thus obliged to have other factories make their army rifle under a licensing agreement; they themselves had to be content with the production of gun sights. The reader will readily appreciate that the Mausers wished to have their rifle machined and assembled in a factory of their own. On December 1, 1873, King Karl of Württemberg consented to the sale of the Royal Gun Factory for a sum of 200,000 guilders. As the Mauser brothers were not in a position to pay such a high price, they solicited a government order to equip the 13th Armeekorps with their M 71 rifle. With this large order in hand, the Württemberg Vereinsbank

1 *Right-hand view, hammer cocked*

The Mauser brothers and their revolver of 1878

3 *Wilhelm Mauser, May 2, 1834 – Jan. 13, 1882*

4 *Paul Mauser, June 27, 1838 – May 29, 1914*

2 *The C 78, cal. 11 mm*

Technical Data Of The Mauser C 78 Hinge-up Revolver

Weight: 1.175 kg; Overall length: 28 cm; Barrel length: 14.2 cm; Grooves: 4; Direction of Twist: to the right; Calibre: 11 mm; Width of grooves: 11 mm; Width of lands: 10.55 mm; Cylinder: Bored for 6 cartridges, length of cases: 25 mm; Sights: Half-moon front sight. Both sights machined from barrel stock; Finish: Frame, barrel and trigger guard burnished; hammer colour case hardened; cylinder, hammer axle retention lever, safety catch, trigger, catch for bolt and coil spring, and all axles blued; locking lever bright; wooden grips.

The Zig Zag Mauser

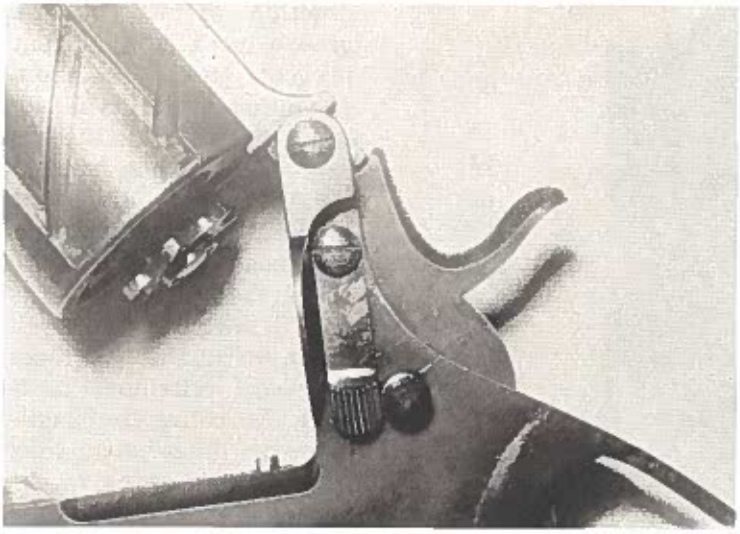
agreed to carry limited liability in partnership, and work at the new plant could begin. Wilhelm and Paul now possessed the factory in which both had served an apprenticeship, where their father still earned a meagre income as a lowly workman; so meagre in fact that the town of Oberndorf denied him citizenship on account of his poverty.

In the initial stages the Mauser brothers were kept very occupied with the marketing of their products. In no way did their enterprise become famous over night, as one might assume today upon hearing the name Mauser. Up tc 1878 the finances had been guaranteed by the military order for the rifles; between then and 1881, however, so many difficulties were encountered that an economic disaster was deemed inevitable. One of the chief causes of this dilemma was a revolver design with which the brothers had been experimenting since 1876, especially Paul. All their combined efforts were channelled into persuading the Prussian army to officially adopt it. A lot of work and time had been put into this model, so it became imperative that Berlin decide in their favor. The German army at that time was not equipped with revolvers so the Mauser brothers were therefore working hard to exploit the situation. France had the Chamelot-Delvigne, Mod. 1873; the US had the Colt Single Action Army Mod. 1872, apart from Remingtons and Smith & Wesson. All these handguns were designed around the center-fire blackpowder cartridge. Wilhelm and Paul, seeing that the time had come for the German army to be revolverized, offered their Mod. 78. Here we should perhaps take a close look at the small arm they designed.

The Mod. 78 was a solid frame tip-up revolver, single action. It did not have the customary flat hammer spring in the grip; in the frame between cylinder and trigger was housed a coil spring (Fig. 5) mounted on a spring guide and slide assembly. At the front end, the spring guide, when the hammer is cocked, projects through the bushing lock, not the spring itself though. The lower extension of the hammer (Fig. 5) is seated in the pocket of the slide without being pinned.

When the hammer revolves around its fulcrum the slide goes forward to compress the spring. The claw-like trigger extension slips into the detent on the underside of the slide and keeps the hammer cocked. The trigger itself has a small flat spring. When the revolver is cocked the spring guide projects 17 mm out of the front of the frame. The hammer axle can be pressed out to the left, once the retention lever has been pushed to one side. The trigger guard is another part that is not screwed in. In Fig. 5 a claw can be seen at the rear end of the trigger guard, which hooks into the frame of the revolver. At the other end (Fig. 8) is a locking catch that can be turned with a nail or similar object. The catch cannot come loose of its own accord since it is connected with the front bushing, which, in turn, is constantly under pressure from the coil spring. When trigger guard and hammer have been removed, it is but a simple matter to shake out the slide assembly together with the coil spring. The hammer has a very smooth action in this model; and even if the main spring were to break the hammer would still cock and drop, as the

5 *Parts of the lockwork*



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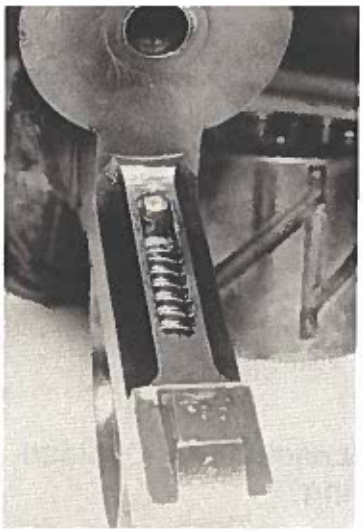
spring guide would hold the two (broken) parts of the coil spring together in working alignment.

How the cylinder rotates

Mounted on the slide (Fig. 5) is a spring ramp with a protruding stud that travels in the cutaway of the frame, as illustrated in Fig. 7. The cylinder has six horizontal and six oblique grooves that form, roughly speaking, a zig zag. Hence the collector's appellation, zig-zag Mauser. When the hammer is down, the ramp spring forces the stud into the rear section of the horizontal groove. When the hammer is thumbed back, the stud travels as far as the junction of the oblique groove without revolving the cylinder.

In this position the revolver is at half cock. Thumbing the hammer back all the way forces the cylinder to turn 1/6th of its circumference, since the horizontal groove, at the



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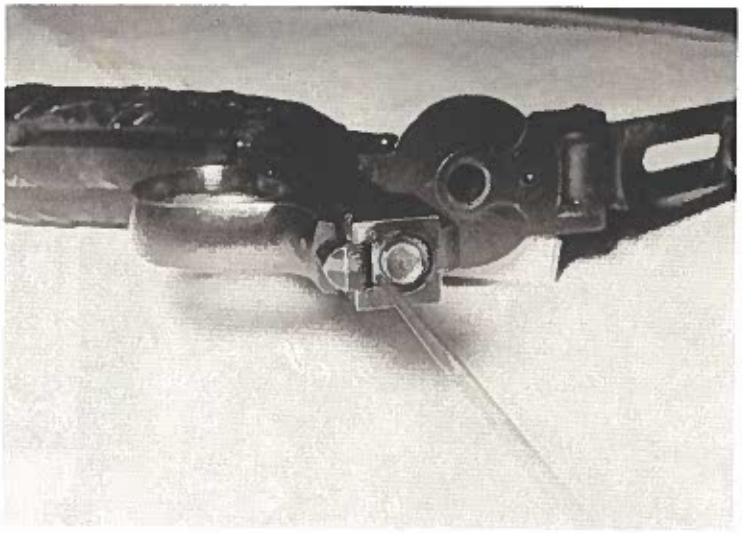

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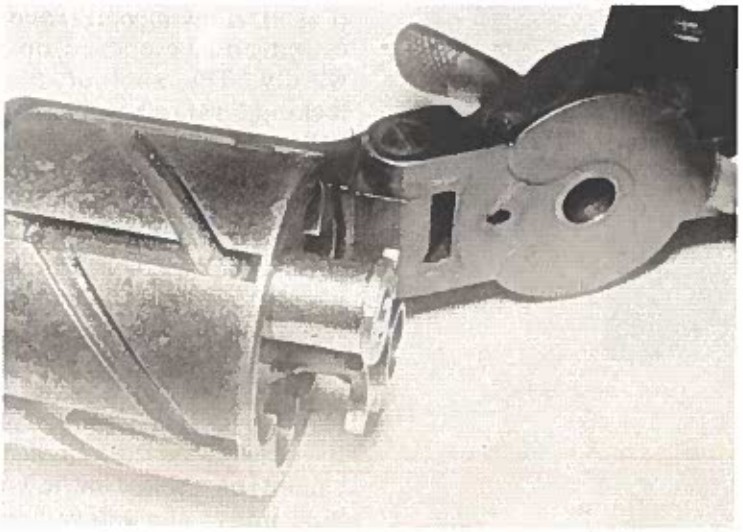

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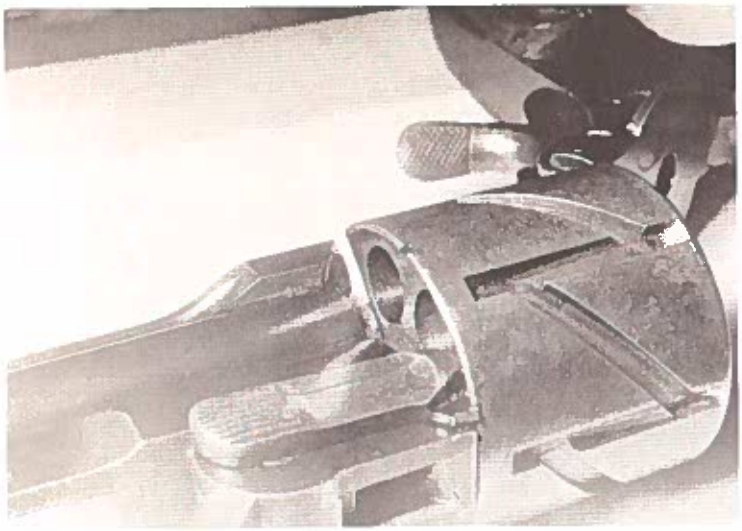
6 *Hammer axle can be easily removed, once clip has been pushed to one side.*
7 *Cylinder stud, part of the slide*
8 *Removing the slide*
9 *Ejecting spent cases*



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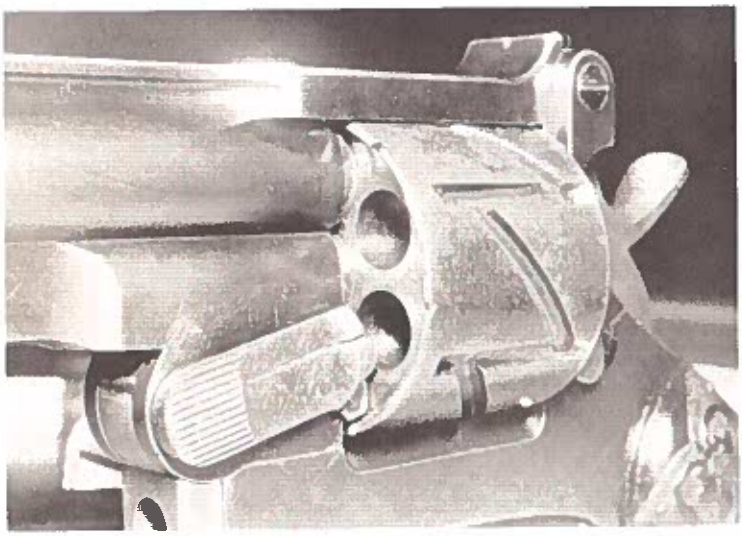

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10 *Safety applied*
11 *See text*
12 *View of the Mauser factory, built 1872/73 (Taken from "Geschichte der Mauserwerke, 1938")*
13 *Top view of C 78*

12

13

junction of the oblique groove, has a shoulder that prevents the stud from travelling straight ahead. When the stud, via the oblique groove, has reached the horizontal groove it moves forward just a little and locks the cylinder; the firing chamber of which is now in line with the barrel. Upon firing, the stud races rearward to its home position, overriding the shoulder from the gradient side, thanks to its spring.

Apart from half cock the Mod. 78 has a safety lever (Figs. 10 and 11) that can be swung over to lock into the cylinder notches. When this safety is applied the cylinder cannot rotate and the hammer cannot be cocked. If the safety is applied after the hammer is cocked, one shot may be fired. This zig-zag mechanism does not permit the cylinder to be turned by hand when the weapon is closed.

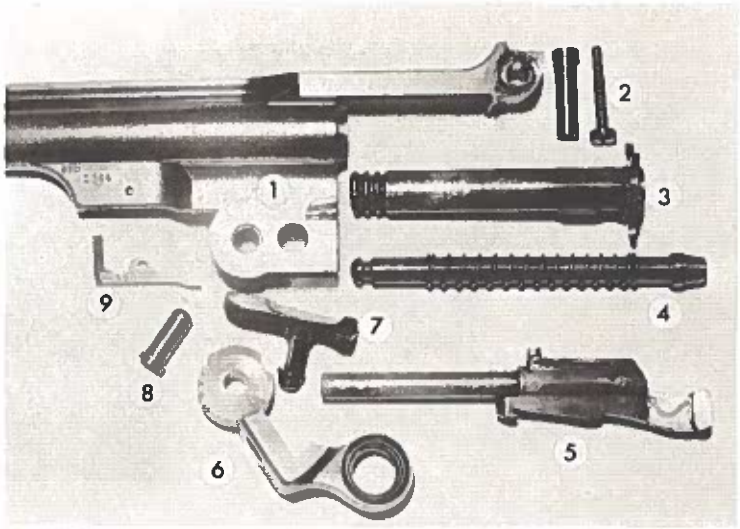
Loading and unloading

The barrel extension is hinged to the hammer post (Fig. 9), allowing barrel and cylinder to be opened upwardly. The ring of the locking lever, when the revolver is closed, lies just ahead of the trigger guard. And since the locking lever is in line with the spring guide it has a hole through which the guide can pass when the hammer is cocked. The locking lever cannot be opened when the safety is in the firing position. On the other hand, the hammer cannot be cocked or lowered unless the safety has

been disengaged after closing the revolver.

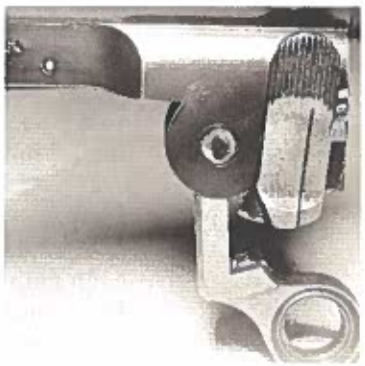
The safety catch, split lengthwise, also functions as its own flat spring. A nose on the underside fits snugly into a metal guide that rotates in a block in front of the cylinder (Fig. 14/1). The safety, apart from locking the hammer (which is of less importance on account of the half cock position), prevents the cocking lever from inadvertently opening and acts as a cylinder stop, too. One might assume, as the hammer is not of the rebounding type, that a cartridge could be accidentally fired when opening or closing the gun. However, this possibility was foreseen, so the barrel extension was so designed that whenever the frame is tipped open or closed, it lifts the hammer to half cock (Fig. 6).

The extractor stem, which is housed under the barrel, keeps the cylinder in place. The bolt and coil spring for operating the extractor are in the stem. The stem itself, integral with the star-type extractor, has three deep rings at its bottom end which are gripped by the teeth of the locking lever. The more the locking lever is pushed in the direction of the barrel, the higher the extractor rides over the spring bolt, ejecting the cartridge cases in the process. In other words, the locking lever fulfils two functions: it unlocks the gun and operates the extraction mechanism. The bolt spring, which is accommodated in the extractor stem, also forces the



14 *Barrel and barrel bearing (1)*
Hinge bolt with locking screw (2)
Stem with star-type extractor head (3)
Bolt and coil spring (4)
Slide (5)
Locking lever (6)
Safety chatch (7)
Axle for locking lever (8)
Catch for bolt and coil spring (9)

15 *Ready for loading*



16 *Locking lever and safety catch positioned for removal*

17 *Locking lever and safety catch off the gun*

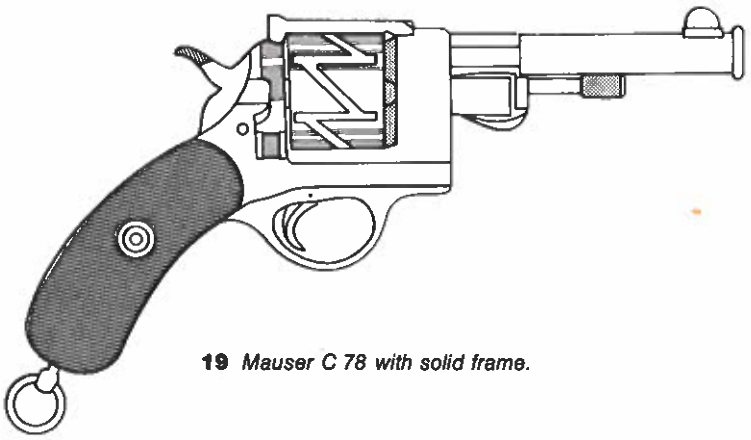
18 *Remington Zig Zag Derringer, Elliot Patents of 1858 and 1860. Taken from Karr "Remington Handguns," 4th edition, 1860.*

cylinder on to the mouth of the barrel, reducing the normal gap between the two to virtually nothing. However, when the gun is opened, and the cylinder freed from its spring pressure, the aforesaid gap widens far enough to permit a folded piece of writing paper to be inserted between cylinder face and barrel mouth.

If you look up the word "revolver" in the 16th edition of the big German encyclopedia, BROCKHAUS, you would think the hinged-frame Mauser revolver was new and revolutionary. It says, "The C 78 revolver, developed by Mauser in Oberndorf, can be credited with being the first prototype of its kind." This is not true. Among the percussion revolvers that saw service during the civil war were the Starr double-action Navy Revolver, cal. .36, and Starr double-action Army Revolver, cal. .44. When the metallic cartridge was introduced, Smith & Wesson marketed the .44 Single-Action American First Issue (Mod. 1869), a thousand of which were used by the Army in 1871. It was the forerunner of the Russian Model and the Army Model 1875, Schofield patent. Its chief feature, apart from being one of the strongest hinged frame revolvers ever built, was its automatic star-type extractor, a novelty in its day. Between 1861–1862 Remington produced a small number of its pocket revolver, sporting six barrels, known as the Zig-Zag Derringer, cal. .22 L. R. (Fig. 18).

The Mauser brothers must have known of this construction, for they corresponded regularly with their brother Franz, who had emigrated to the US in 1853 and worked at the Remington factory. Please don't misunderstand me, this is no slur on the Mauser design. I just want to point out how far technical developments had gone at the time Wilhelm and Paul Mauser were endeavouring to get their C 78 adopted by the German army. In view of the developments in America and elsewhere, the Mauser brothers were late, very late, in approaching governmental departments for large orders. The officials in Berlin were courteous and praised the C 78, but orders were not forthcoming.

Neither was the C 78 successful in Petersburg, Berne or Cristiana. Full of despair, Wilhelm wrote to his brother: "Everywhere, too late, too late." Paul replied in October, 1878, saying that he would have to dismiss the personnel unless an order was secured. In April, 1879, the top brass in Berlin came to a decision: the revolver developed by the Spandau Military Commission would be adopted. This sealed the fate of the Mauser C 78. Whether the Military in Berlin chose wisely or not cannot be discussed here in detail. Many factors influenced the Army Commission; above all the fact that the Reich revolver was in its final phases before the Mauser brothers turned up. But one thing can be said for sure, the Reich revolver was not as perfected as the



19 *Mauser C 78 with solid frame.*

C 78, and was technically not so advanced. The Mauser innovations were so simple and straightforward that the C 78 could have been adopted for military use without hesitation. The extractor system was particularly rigid, resembling that of the Smith & Wesson. The lockwork was rugged and could be disassembled without tools. And the Mauser finish, of course, is proverbial. By the way, the Mauser brothers half reckoned with the Military's antipathy for hinged-frame revolvers; Smith & Wesson's hinged frame did not meet with approval either in Germany, and there is no denying that solid-frame revolvers are stronger.

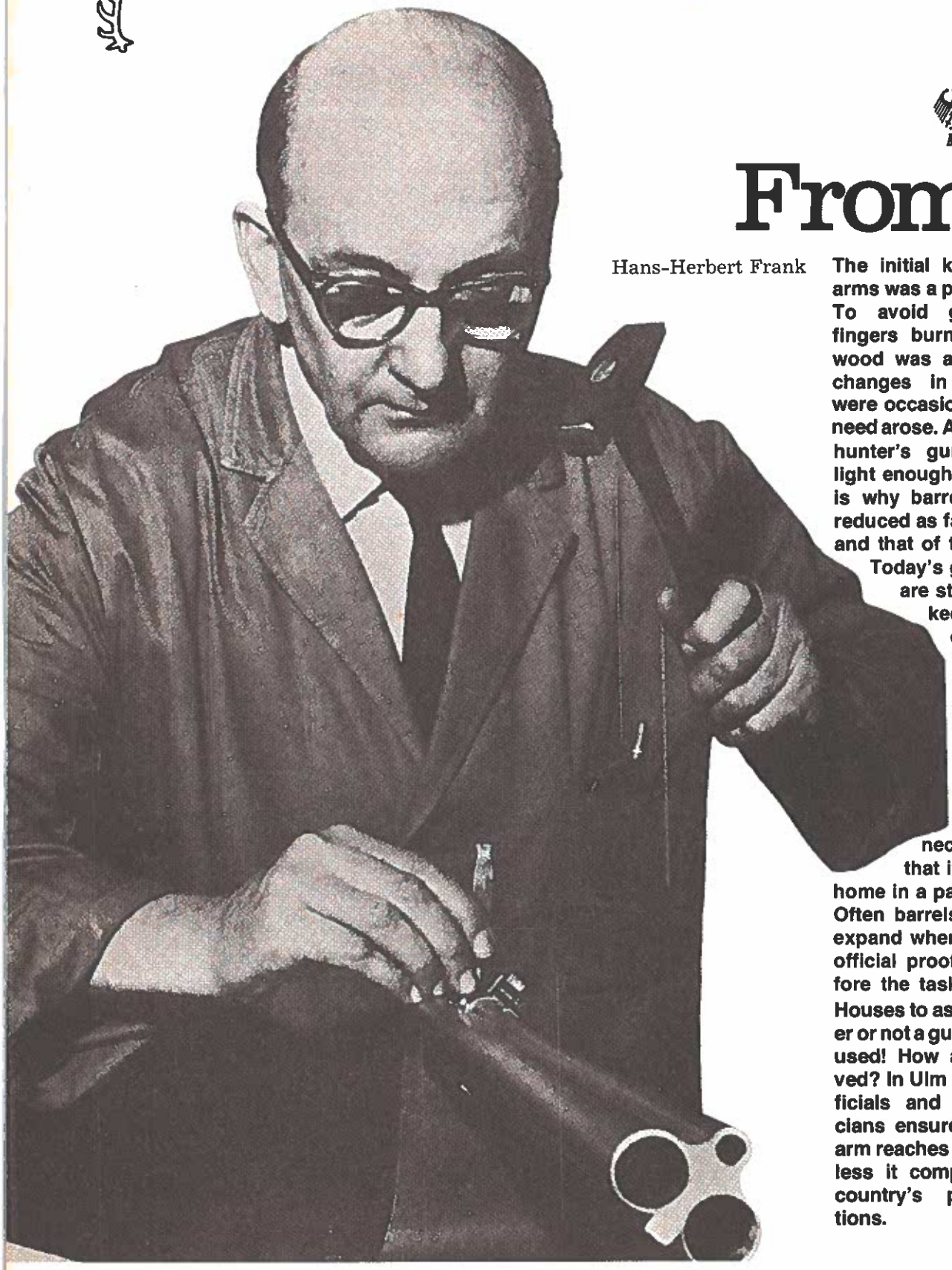
Wilhelm and Paul accordingly constructed a solid-frame zig zag model (Fig. 19) too. The chambers were loaded and unloaded by rotating the cylinder to line up with a loading gate, spent cases being poked out with a built-in ejector bar. Externally, the two C 78 models now looked quite different. Still, even this noteworthy improvement could do nothing to change the Berlin resolution.

Attempts to interest the Austrian army also misfired. Hard times set in for the factory at Oberndorf. Paul had started production of the C 78, and insignificant orders were received from Württemberg and Bavaria, plus a few from private circles. This revolver was fabricated in 10.6 mm, 9 mm and 7.6 mm. Very few of the solid-frame model were produced. Owing to the lack of sufficient orders, the financial situation of the Mauser works got gloomier from day to day after 1878. The revolver on which Wilhelm and Paul had pinned their hopes had catapulted them into the jaws of adversity, and the silent partners of the company began to circumscribe the brothers' full liberty of action. Deliverance from their ill fate was not forthcoming until Serbia ordered an improved Mauser rifle in 1881. A contract for 120,000 infantry rifles was signed in Belgrade on February 14, 1881. This was a red-letter day for the people of Oberndorf. The newspaper, "Der Schwarzwälder Bote" reported the event as follows:

"Anyone who knows what the gun factory means to Oberndorf, knows that it pays RM 22,000 in wages every 14 days, the main part of which remains in the village. Anyone who remembers the recent low spirits of the Oberndorfers when the factory was partially closed and workers had to be dismissed, knows how badly business was faring in every branch; how innkeepers, landlords and craftsmen were lamenting, will understand that outburst of joy at receiving the telegram last week confirming the new order; a reliable envoy for better times, for better wages, for better business deals in the years ahead."

✽

Things began to brighten up again and the Mauser brothers confidently looked forward to coping with new designs. The C 78 receded into the background and was eventually abandoned.



From Hal

Hans-Herbert Frank

The initial kickoff to firearms was a piece of tubing. To avoid getting one's fingers burnt, a piece of wood was added. Further changes in construction were occasioned when the need arose. A gun, at least a hunter's gun, should be light enough to carry. That is why barrel weight was reduced as far as possible, and that of the stock, too. Today's gun designers are still essaying to keep their weapons light. This is O.K. as long as durability is not sacrificed. Compulsory proof of a defective barrel does not necessarily mean that it can be taken home in a paper bag.

Often barrels just twist or expand when subjected to official proofs. It is therefore the task of the Proof Houses to ascertain whether or not a gun can be safely used! How are guns proved? In Ulm twelve gun officials and proof technicians ensure that no firearm reaches the market unless it complies with the country's proof regulations.

lmark to Proof Mark

In West Germany proof pressures must be at least 30 per cent in excess of those of maximum commercial loads. Hairline cracks or other minute defects must then show up. Generally speaking, all firearms, starting with cal. .22 must by law be submitted to proof testing. Distinct differences are made between rifles (those firearms with rifled barrels) and shotguns (which are smoothbores). Revolvers, pistols and cannon for firing off military salutes make up the third group.

There was a time when every gunsmith proved and stamped his own wares; a practice that introduced the hallmarks of the guilds.

Nevertheless, in the course of increased industrialization during the last century, it was readily admitted by many parties that government control was necessary. The hallmark gave way to the proof mark. In 1891 a decree established obligatory proof for the black powder weapons of the time. At the turn of the century guncotton made its appearance, also steel-jacketed bullets, so barrels had to be changed to cope with progress, and new proof laws had to be drafted and issued to meet the new demands. However, it was not until June 7, 1939, that it became law in Germany that all firearms and cartridges had to be subjected to proof.

This new law took into consideration the fact that both cartridges and weapons must be officially tested, since they are interdependent. The 1939 legislation is subdivided into two sections; the first for guns, the second for ammunition.

Other significant nations, e.g. Belgium, England, France and Italy also have state-controlled proof houses. These countries signed an agreement on July 15, 1914, together with Spain and the then Austria-Hungary, to recognize the proof marks of the co-members. An international proof commission (the CIP) was also set up to coordinate the methods and proof loads used within each member country. Regular meetings are held in the host country of the year. Weapons arriving from non-member states must be re-proved. In the meantime Czechoslovakia, Chile and Yugoslavia have become members of the CIP. In Ulm, the Dept. of Commerce of Baden-Württemberg holds all responsibility. Proving is carried out in a disused fortress which once accommodated the Oberndorf (Nekkar) proof house. Another such establishment is in Munich. The Standards Departments of the German states maintain small arms testing centers at Kiel, Hanover, Cologne and Berlin.

Photos:
Hans-Herbert Frank

The majority of the work is carried out on new guns for the civilian markets. The German Armed Services do their own proving. Then, of course, there are repairs that have to be reproved; for every gunsmith is obliged to send in weapons that have been re-bored or re-worked in any way that could undermine durability.

Every gun is subjected to various inspections, visual and mechanical, prior to being proved. The grooves and lands of the rifling are measured to ensure a perfect fit of the bullet. If the bore is too small excessive gas pressure can build up. The chamber is likewise calibrated to see whether minimum tolerances have been retained. The ammunition factories are obliged to work to maximum tolerances, so both these tolerances may not overlap. On the contrary, a thickness barrier of 0.02 mm lies between the two. In other words: A cartridge can never be too large to fit the chamber. What does occasionally happen, however, is that sportsmen force a shotgun shell of 70 mm length in to a gun chambered for 65 mm shells. The shell or the action of the gun, or both, may rupture as a result of the extra surge of gas pressure. So just don't use 70 mm shells in 65 mm chambers!

Gun manufactures do their best to keep the bore of a rifle to its correct limits. If the bore is overdimensioned, or has been damaged by wear, the gasses by-pass the bullet before it leaves the barrel. This in no way improves ballistics, and a bullet that exits the barrel out of true begins to wobble.

Furthermore, headspace is vitally important. For the 8 x 57 mm cartridge the tolerance should not exceed 0.15 mm. With high-performance cartridges the headspace tolerance must be within 0.10 mm. It will be obvious, too, that the barrel must be absolutely free of burrs and other obstructions.

The gun is then mounted in a firing cradle for the final proof. No one may remain near the gun, all firing is done from an adjacent room by means of a long piece of cord fastened to the trigger. In Germany it is required by law to discharge two special cartridges in each barrel; shotguns being tested with one nitro cartridge and one blackpowder cartridge.

The technicians have to be wide awake and wary,

2 *Technician gauging the bore of a shotgun*
3 *This Intra device measures down to 1/100 mm how far the chamber is out of round or has expanded.*
4 *Right page: Technicians in Ulm inspecting a new batch of weapons. In the foreground Italian Glisenti revolvers without proof marks. Special loads will have to be made up for proving them.*

2

3

for occasionally a gun does burst or is blown to smithereens; especially the so-called "amnesty" guns that are handed in by the general public. Once tested the weapon is again subjected to visual and mechanical examination. The technicians of the proof houses very much regret that there is no law in force to have guns re-checked at regular intervals; similar to today's controls for public vehicles. Corrosion and oxydation are factors that cause accidents. They think hunters and other gun-shooting groups should acquaint themselves more with inherent dangers, and call in to see their collection of split barrels, etc.

What does proving a gun cost? This is based on Section 21 of the Third Enactment of the new German Gun Laws of 10th May, 1973. The rates depend on the work done, as well as on hourly charges of the civil servants employed. For the services of the rank and file one pays DM 23, for the qualified technicians DM 27, and for the services of the executives DM 33 per hour. In addition each barrel of a shotgun costs DM 3.30 plus the cost of the shells. The form that has to be filled in costs DM 0.60, and packing/unpacking, cleaning, oiling, etc. cost DM 8.95. In total, proving a rifle costs DM 17.85, and proving a double-barralled shotgun DM 20.15 (approx. 8 US dollars).

Should the gun not pass the tests it is returned with a list of deficiencies. If, for example, the headspace is more than it should be, the amount of adjustment to the last 1/10 mm is stated. One copy of the delivery note, on which the findings are recorded, is kept at the proof house, the other goes to the customer. Surprisingly enough, even qualified hunters (in Germany every hunter is subjected to severe training and tests to get a licence) often do not know the meaning of the various proof marks. Espying an antler and a date on the gun, many a hunter is of the opinion that his weapon has passed with flying colours. This is not so! The antler sign means the gun must be adjusted or repaired and returned to the proof house. If the gun has passed it will be stamped with (in Ulm) the German eagle, the year and letters signifying the type of charge(s) used.

Together with its subsidiaries, the Ulm proof house proves monthly about 35,000 weapons. About 8–10 of the guns are

5 *Bottom left: Shotguns are tested with one blackpowder and two nitro shells for each barrel.*
6 *Buckshot for the blackpowder shells.*

5

6

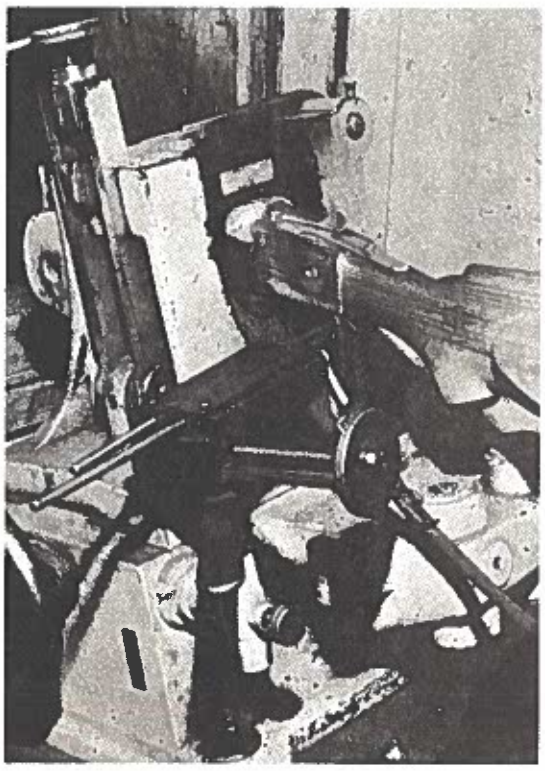
oldies, the rest are new for target enthusiasts and hunters.

The ballistic lab of the proof house in Ulm is equipped with the most modern instruments. Gas pressures and bullet velocities are measured for the ammunition industry and for amateur reloaders as well. The gas pressures of proving cartridges are subjected to continuous inspection. Proof pressures are at least 30 per cent higher than those of maximum commercial loads. Proving cartridges are normally obtained from ammunition manufacturers. However, for a few foreign and obsolescent calibres, the proof house determines the load itself. For the majority of cartridges readily available today special barrels for measuring gas pressure are at the technicians' disposal.

To determine gas pressure at least 10 cartridges are taken from a given series, and in each cartridge a 2 mm hole is bored. The gas-pressure barrel has also a 2 mm hole running to the chamber. When the cartridge is chambered it is rotated until the two holes line up. At the other end of this passage is a moving steel piston, over which a copper stud is placed. The stud is held in at its far end by a thumbscrew.

7 *Otto Heitzmann, head of the Ulm proof house.*

When the shot is fired some of the gas in the chamber jets through the passage and sets the steel piston going hell for leather in an upward direction. This ramming action squeezes the copper stud against the thumbscrew, the stud losing its original shape. Its length is then miked to ascertain the gas pressure. This procedure is repeated with all 10 cartridges. The mean value of the 10 cartridges must read at least 30 per cent higher



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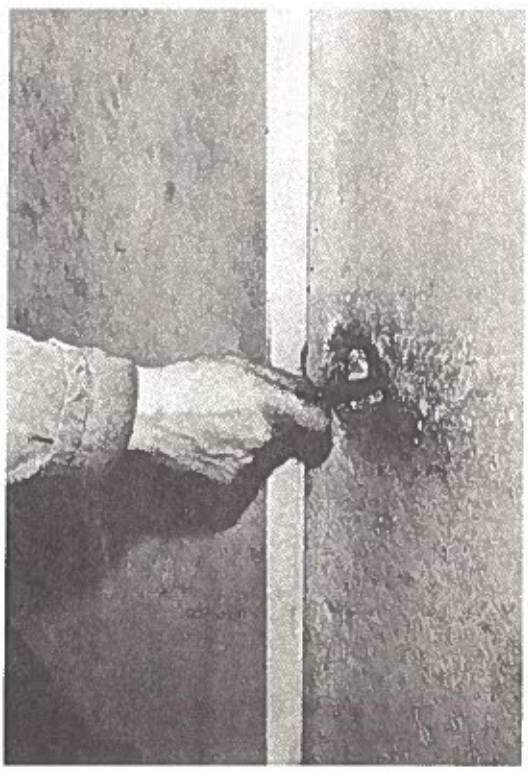

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8 *A drilling mounted in a cradle with the barrels pointing at the water room. Note remote control attachment with bar passing in front of the trigger.*

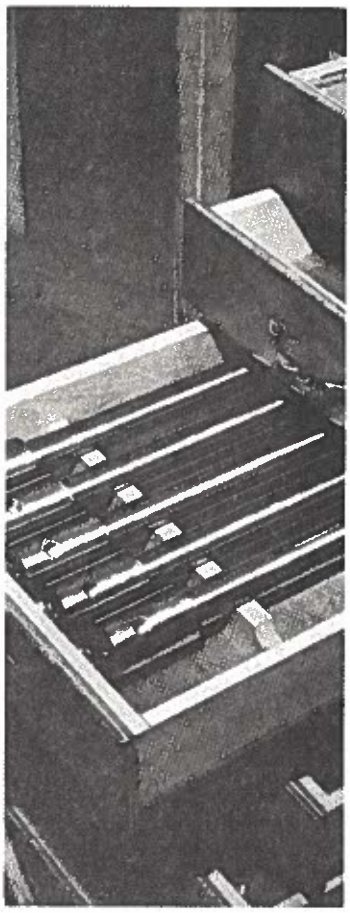
9 *Firing from an adjacent room.*

than normal loads, otherwise proving would be meaningless. On the other hand, the proof cartridges must not be overpowered, for fear of causing lasting damage to the gun.

According to an international provision, the method described is the only lawful way of measuring gas pressure. The proof house in Ulm is also provided with a microchronometer for measuring velocity.

The ammunition factories measure gas pressure in the same way. To achieve conformity, the gas-measuring devices of the proof houses and those of the Physikalisch-Technische Bundesanstalt in Brunswick are periodically compared with those of the ammunition manufacturers by trial shooting.

There are today more modern methods of testing gas pressure on the market, but these so far have not been internationally recognized. However, Ulm is experimenting with the latest techniques, the most promising being the quartz crystal unit attached to an oscillograph, whereby the total pressure curve is made visible from start to finish. The results being photographed. A further development of this system is an apparatus that shows top pressures immediately. The technician can set the apparatus for various calibres in advance. This is necessary, for the scale can only cover a specific range of gas pressures at a time. The needle remains steady a few seconds at the pressure point, then gradually drops to zero. For the sake of rationalization, modern measuring techniques will



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10 *Left page: The paper-bag department. In the foreground a hammer-type shotgun with broken frame. A part had been welded, illegally and badly.*

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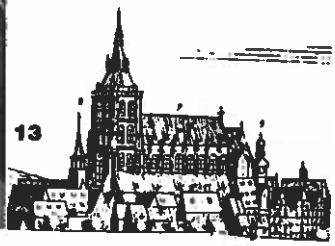
11 *Barrels in many calibres for testing gas pressure.*
12 *Technician boring a 2 mm hole in the case of a proving cartridge.*
13 *A copper stud being inserted into the pressure barrel.*



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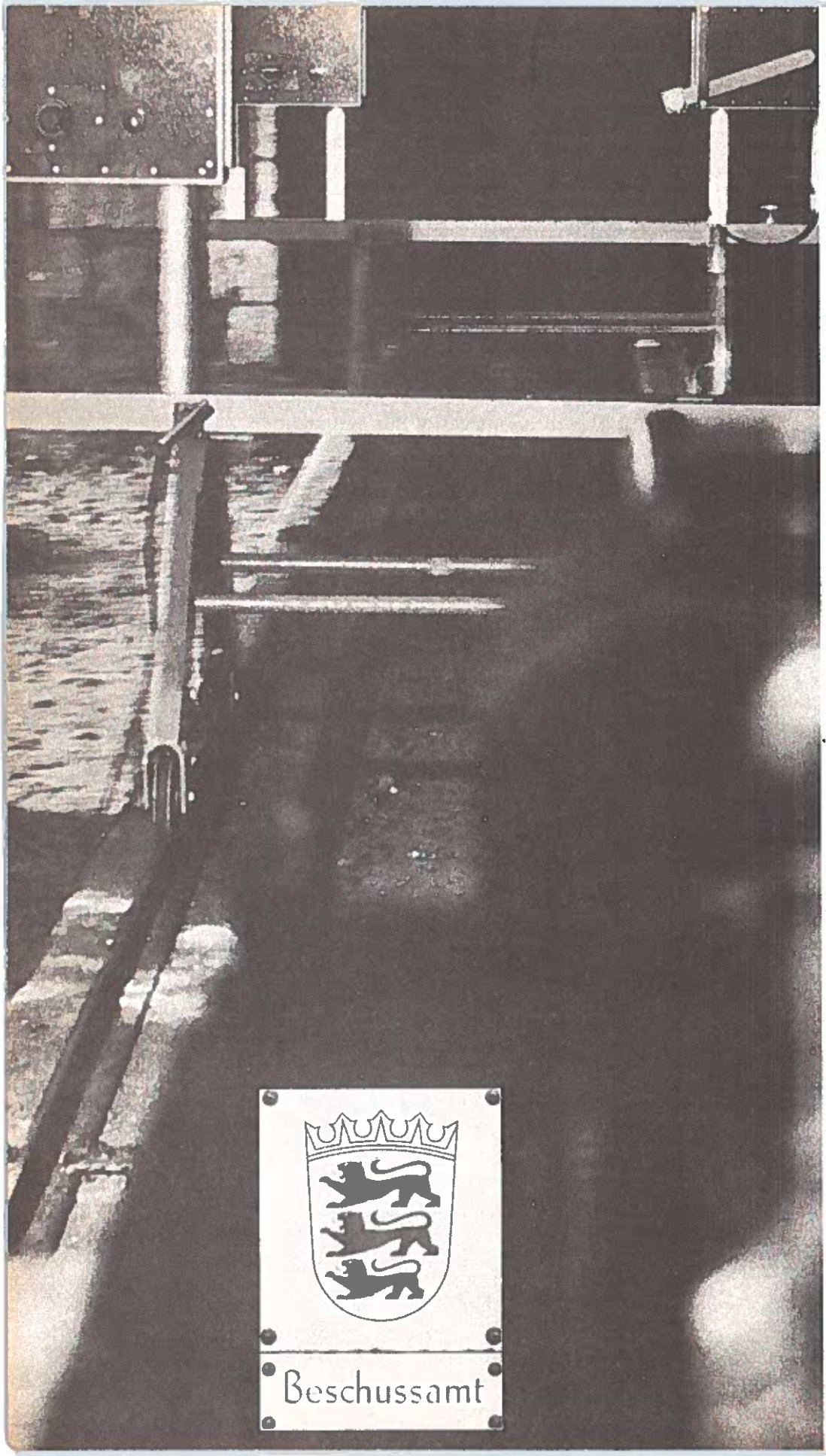

have to replace the older methods in time.

The Ministry of the Interior of Baden-Württemberg has issued a decree that home loaders must every 3 years present, without official request, 10 of their home-made cartridges to the proof house for inspection. Reloading in Germany is rather a rare hobby, but an increasing number of gun buffs are now loading their own .38 wad cutters. Should, however, more than 1000 cartridges be reloaded within 3 years, samples must be sent in after each lot of 1000 cartridges, irrespective of time. After a course of instruction in reloading, the Ulm proof house received its first reloads. Tests proved that all the cartridges were either over – or underloaded. It is no simple matter to keep gas pressures in their correct limits, for a great number of factors play a decisive role, apart from the actual powder load.

◀ **14** *Apart from measuring gas pressure, the proof house in Ulm is equipped to ascertain bullet velocity with a light-barrier chronometer.*

15 *Dial gauge for measuring copper stud after barrel has been fired.*

16 *Modern apparatus for measuring gas pressure which has not yet been internationally recognized. Oscillograph that measures total pressure from start to finish.*

17 *Hardness-test procedure. The tensile strength of metal parts is checked when, for some unknown reason, expansion has set in.*

18 *Gas pressure as seen on an oscillograph screen.*

19 *A barrel set up under the engraving machine.*

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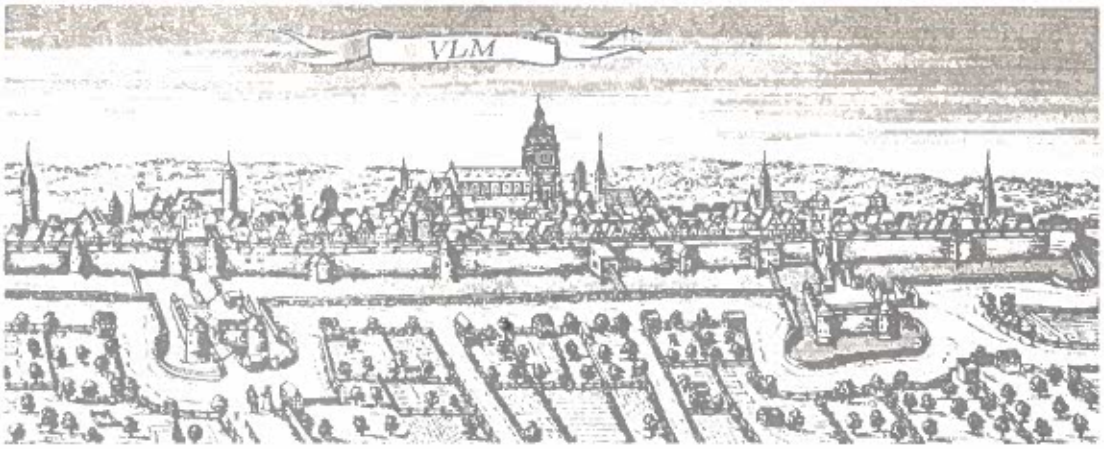

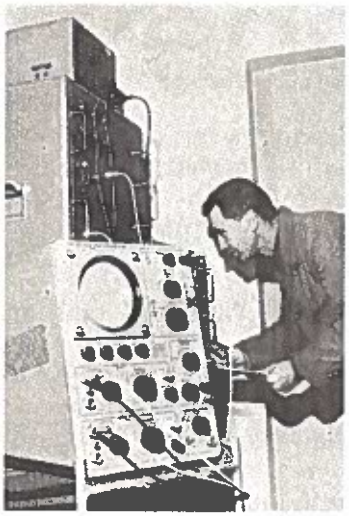

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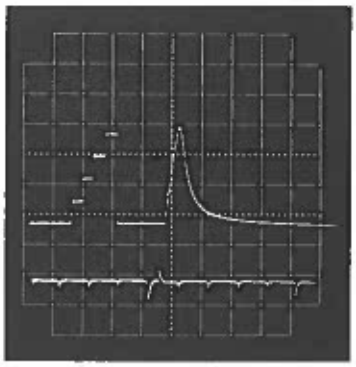

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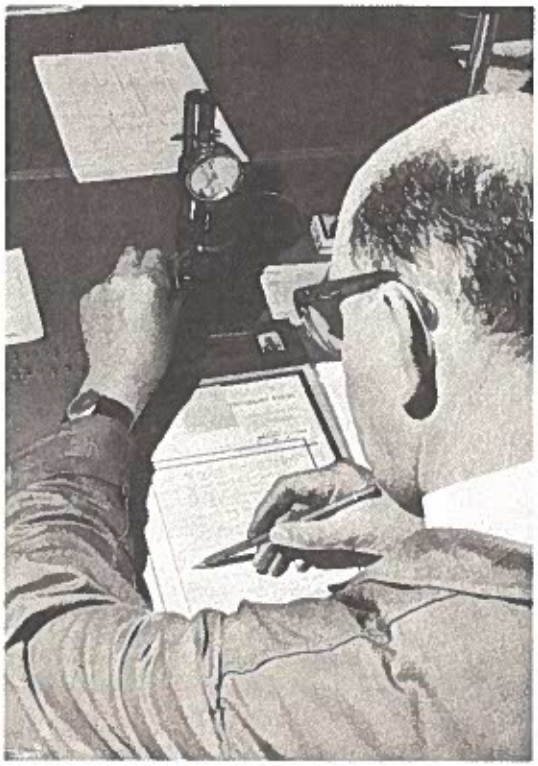

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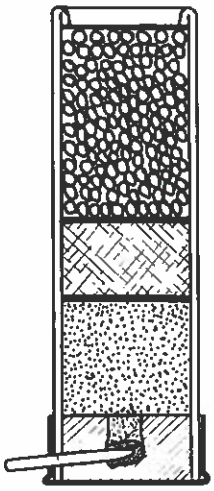
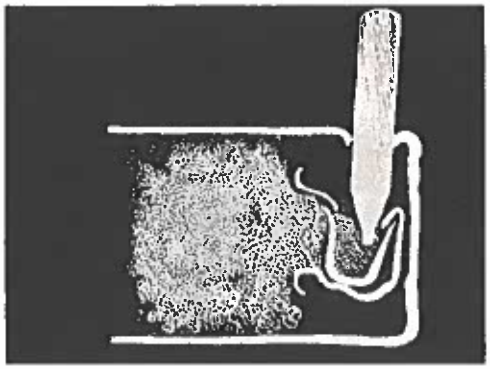


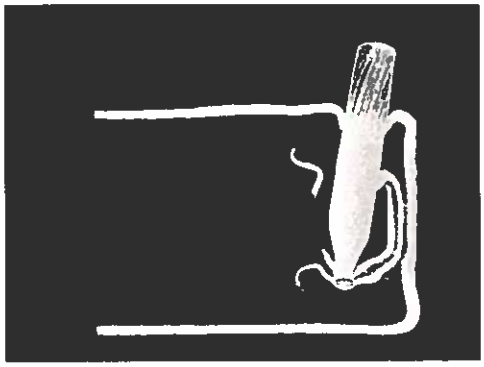
1 *Cross section of the Lefaucheux shotshell. Note pin seated in detonator cup.*

Many of the weapons illustrated were kindly lent to the author by Mr. Engels of Reichenstein.

The Lefaucheux



2 *Phantom view of a live revolver round (without bullet) showing the pin resting in the detonator cup.*



3 *The same cartridge, showing the punctured detonator cup after firing.*

For a better understanding let us begin with the Lefaucheux cartridge and its particular form of ignition. Fig. 1 shows a cross section of the Lefaucheux shotgun shell. Apart from the powder, wads and shot in the crimped case a metal pin can be seen sticking out of the brass base. When hit by the hammer this pin crushes the primer within the case head and fires the main charge. Fig. 2 is a sectional view of a live revolver round (without bullet). A cross section of the same cartridge in Fig. 3 shows the punctured primer cup after firing. Lefaucheux's revolver cartridge cases were usually of brass, though sometimes of copper.

The hinged-frame shotgun designed by Lefaucheux in 1832 is locked by a T-shaped segment of the underlever (Fig. 4), quite an achievement for a gun made about 140 years ago. Fig. 7 illustrates a double-barrelled Lefaucheux in the open position. Note the swung-out underlever, the T-shaped segment under the barrel lugs, and the pin of the shotshell sticking out of its slot. Figs. 5 and 6 show the typical Lefaucheux forearm hingeplate, which rotates as a part of the receiver. The small, front locking lever that swings out to the left, not to the right as the underlever does, holds the barrels in place.

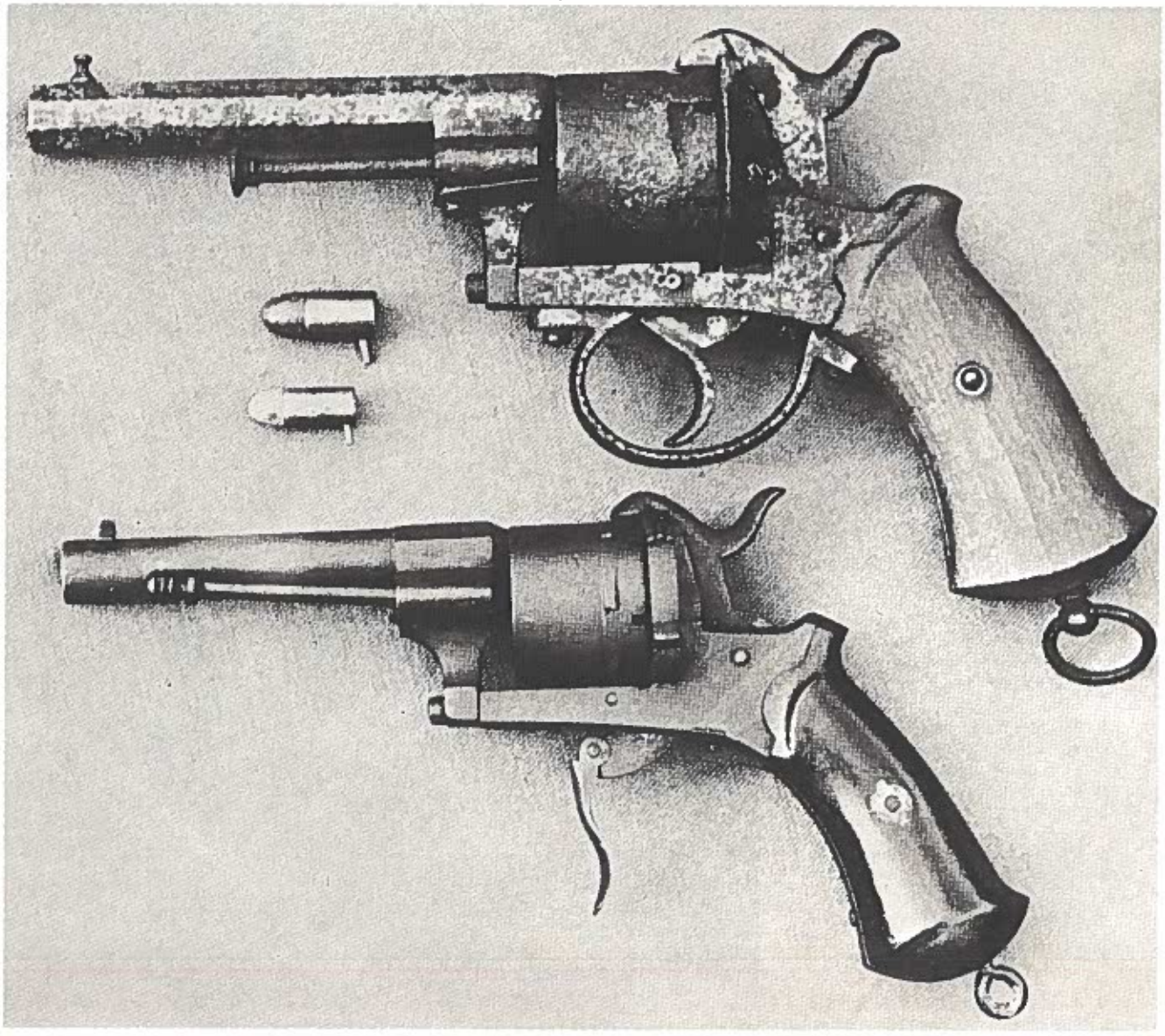
The protruding pins of these cartridges were both visible and tangible proof that the gun was loaded. The Lefaucheux shotguns were extremely popular with huntsmen, even at the beginning of this century. However, the pin-fire system was not adopted for military weapons, presumably for fear that the pins of the cartridges could be easily actuated during transportation.

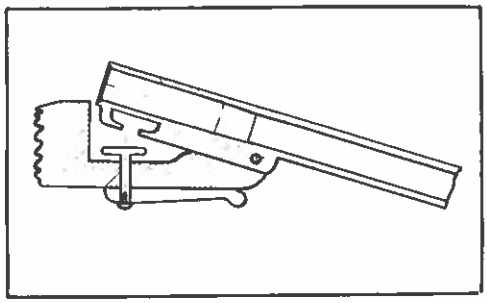
The development of the pin-fire system took place between 1825 and 1836. Gevelot, another Parisian, improved on the system and began mass production before 1838.

Since the Lefaucheux pin-fire cartridge was so popular with hunters, other makes of guns for this system soon appeared. Figs. 8 and 9 show a Roux double barrelled shotgun with underlever. The pin can be very clearly seen in Fig. 8.

Round about 1830 Lefaucheux, a Parisian gunsmith, started experimenting with breech loaders and with fixed ammunition that would expand as a gas seal at the instance of firing. Many years later Lefaucheux designed the revolver that was named after him.

Pin-Fire System





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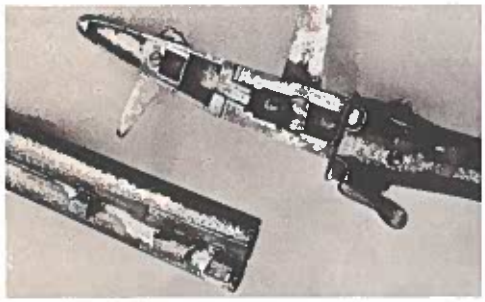

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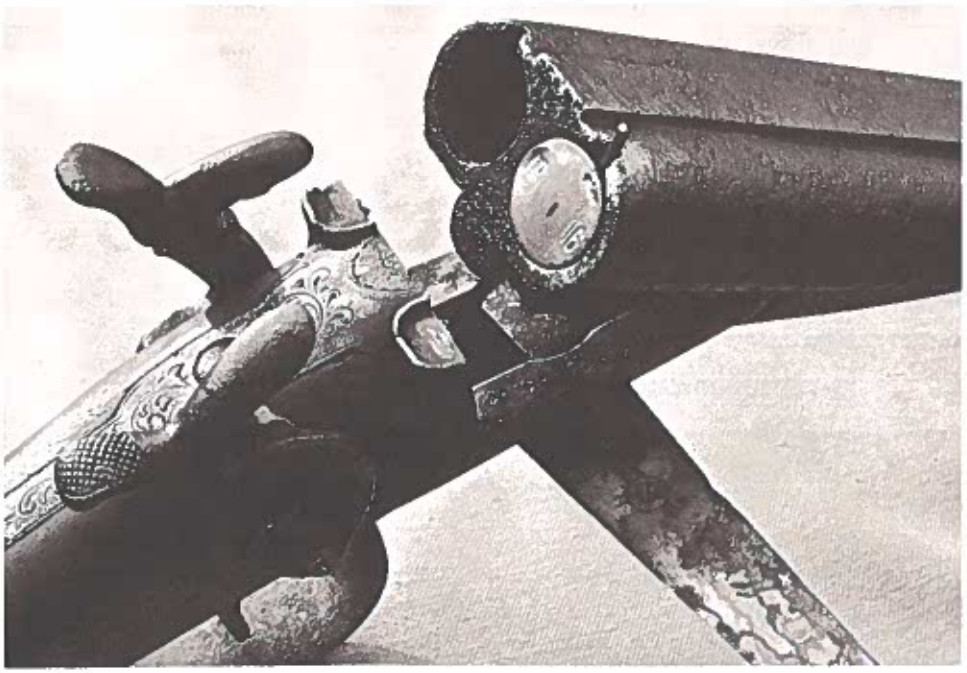

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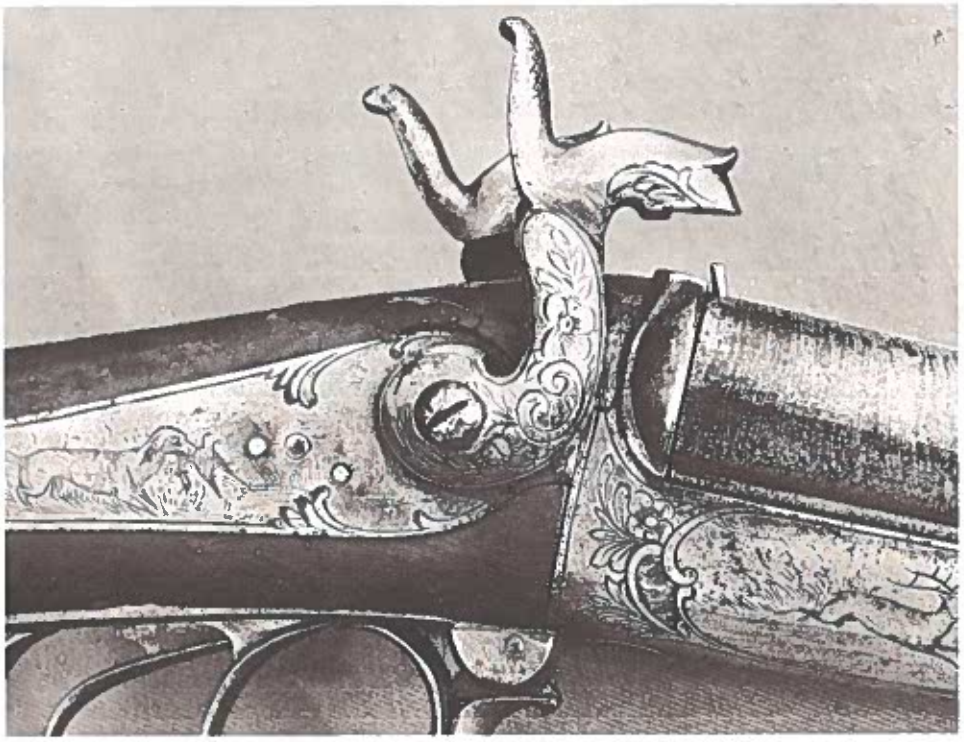


4 *Typical Lefaucheux breech lock. Underlever has T-shaped segment that fits into the barrel recess.*

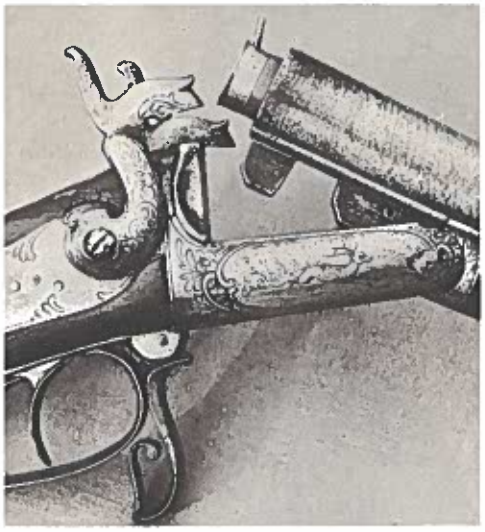
5 *Forearm-type hingeplate. The small lever pointing to the left locks into the barrel lugs, the large lever pointing to the right actuates the T-segment to lock the breech.*

6 *The same gun as above, seen from below.*

7 *A Lefaucheux shotgun showing a 16 gauge shotshell in chamber, with pin.*

8 *A Roux shotgun for Lefaucheux pin-fire shells. Hammers at half cock.*

9 *The same Roux shotgun with opened breech. Note underlever in front of trigger guard.*
10 *How the Lefaucheux single-action revolvers work. Description of operation in text.*



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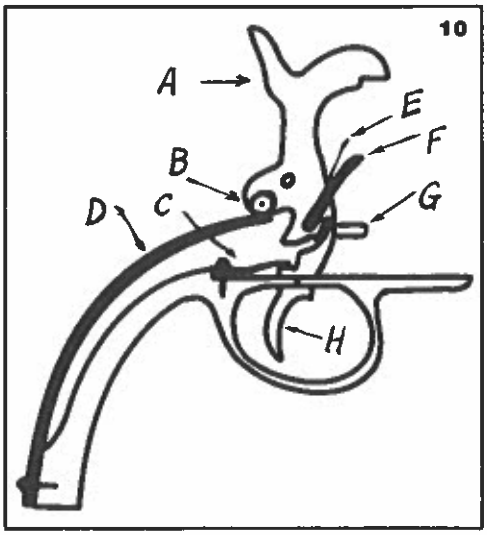

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On the other hand, Lefaucheux's T-type locking mechanism proved so reliable that it was later carried over to many a modern centre-fire shotgun.

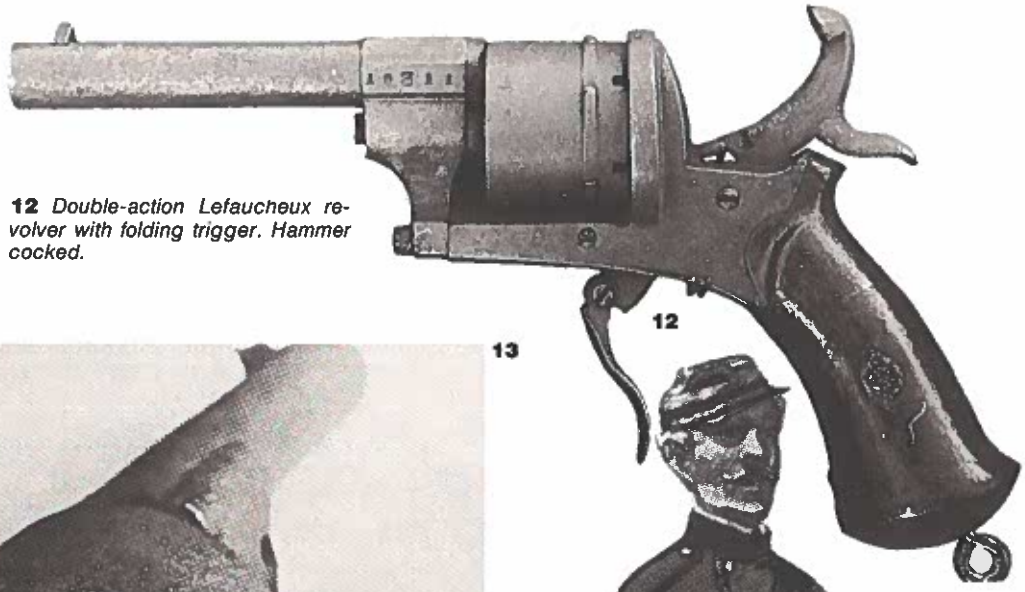
In time pin-fire cartridges were fabricated by all the larger ammunition manufacturers. Lefaucheux cartridges were considered absolutely impermeable to gas after Houllier invented the base wad around 1845.

As mentioned earlier, Lefaucheux designed a revolver for his pin-fire cartridge. It was displayed at the Worlds Fair in 1851, and letters patent were granted in 1853.

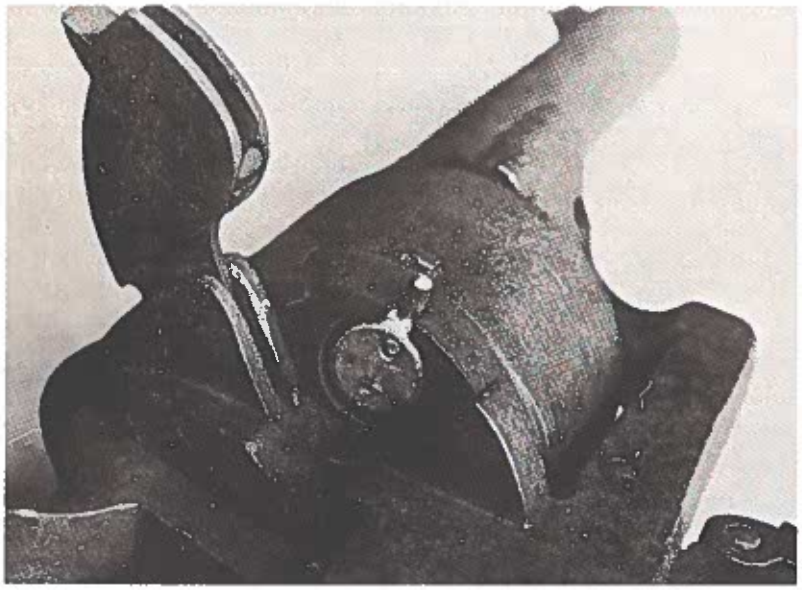
First of all, he converted a Mariette pepperbox to his own pin-fire system, a design that was adopted by the French army in 1863. The first models were single action, later models double action.

Lefaucheux's double-action revolver was later fitted with lockwork designed by Chaineux in 1853. The French navy adopted a Chaineux double-action revolver in 1855. Fig. 10

11 *Top: 9 mm double-action Lefaucheux; Bottom: 7 mm double-action Lefaucheux*



12 *Double-action Lefaucheux revolver with folding trigger. Hammer cocked.*



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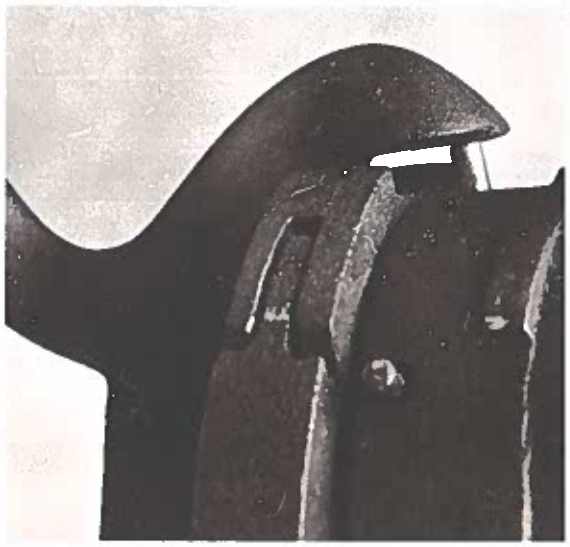
13 *Each cartridge was placed in its chamber one at a time through the loading gate.*
14 *Hammer resting on pin, the bulge of the action face is designed to protect the pins when not aligned with the hammer recess.*



14

shows the functioning of the Lefaucheux single-action revolver.

When cocking the hammer (A) the mainspring (D) is depressed via roller (B), whereby the trigger (H), tensioned by the trigger spring (C), engages with the detent of the hammer (A). The pawl (F), supported by spring (E), rotates the cylinder, which is then locked in the firing position by bolt (G). On pulling the trigger (H) the hammer (A), on account of the mainspring (D), flies forward and hits the pin of the cartridge. Thumbing the hammer (A) again rotates the cylinder to the next chamber.

In Fig. 11 we see two double-action Lefaucheux revolvers with cartridges. The larger one chambers a 9 mm round, the other, guardless with folding trigger, fires 7 mm cartridges. The 7 mm model is illustrated again in Fig. 12 with a cocked hammer. Note the holes through which the pins protrude when the chambers are loaded. As seen in Fig. 13 the cartridges are loaded through a gate, and the bulge of the action face is designed to protect the pins when they are not in line with the hammer. Fig. 14 is a close-up view of the hammer hitting the pin; note the cutaway to allow the hammer to fall squarely on to the pin.

Fig. 15 gives a very good idea of the make-up of the Lefaucheux pin-fire cartridge. The ones shown here are cal. 11 mm, the case is of copper, the pin of brass, and the bullet of soft lead. Fig. 16 illustrates a shotshell, 16 gauge, and from left to right the following revolver cartridges:

Shot cartridge cal. 7 mm, blank cal. 7 mm, with lead round ball cal. 7 mm, with lead round ball cal. 9 mm, with lead round ball cal. 11 mm. Fig. 17 shows an original pack (metal packed) of 7 mm Lefaucheux cartridges.

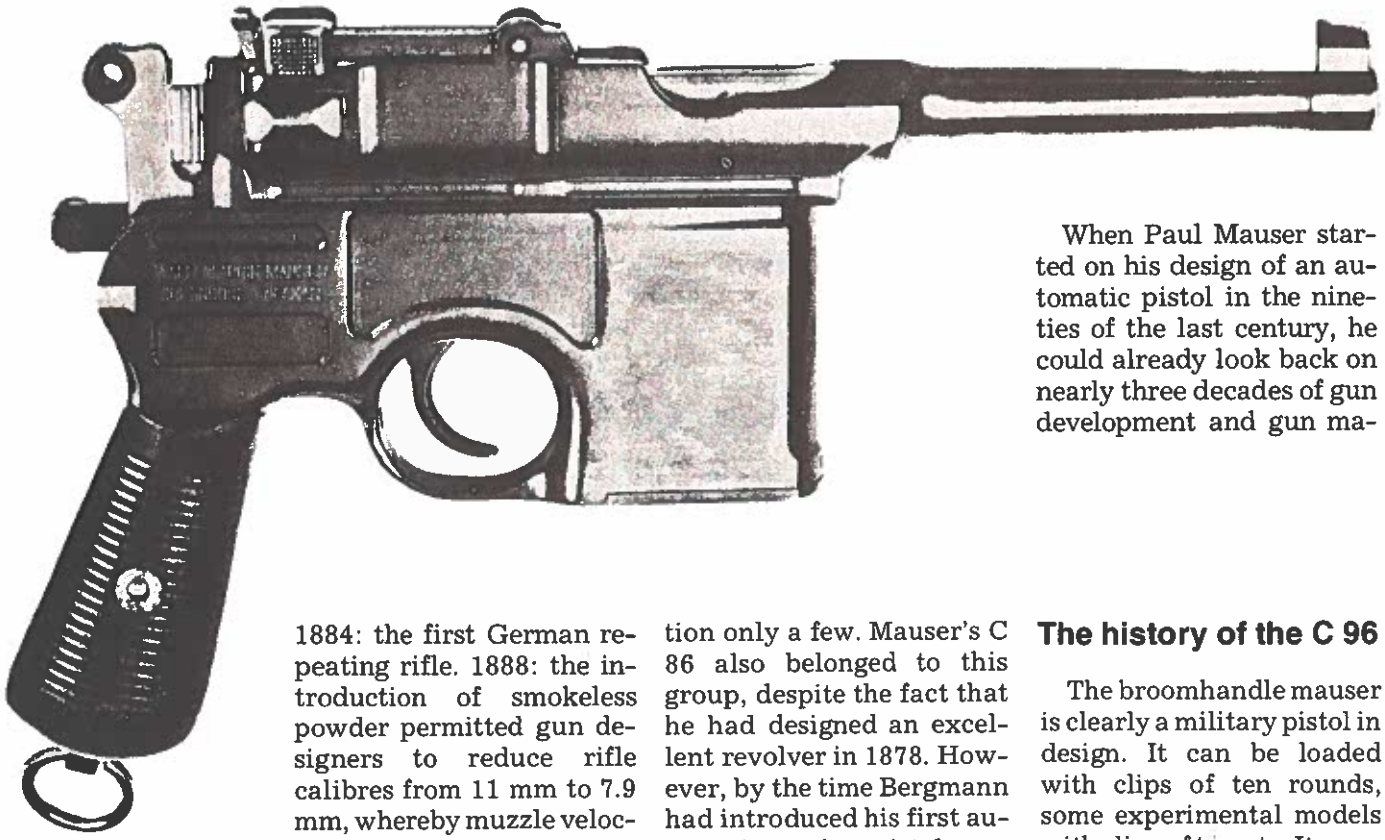
15

16

17

15 *Lefaucheux revolver cartridges cal. 11 mm. The case is of cooper, the pin of brass, and the bullet of soft lead.*
16 *Lefaucheux cartridges. Top: 16 gauge shotshell. From left to right: Shot cartridge cal. 7 mm, blank cal. 7 mm, with lead round ball 7 mm, with lead round ball 9 mm, with lead round ball 11 mm.*
17 *An original pack (metal packed) of 7 mm Lefaucheux cartridges.*

Broomhandle



1 *The shortie C 96 with a 98 mm barrel. Known in America as the Bolo Mauser. A prized collector's item! Note angular grips.*

When Paul Mauser started on his design of an automatic pistol in the nineties of the last century, he could already look back on nearly three decades of gun development and gun ma-

1884: the first German repeating rifle. 1888: the introduction of smokeless powder permitted gun designers to reduce rifle calibres from 11 mm to 7.9 mm, whereby muzzle velocity rose from 440 to 620 mps. Technical developments improved the rate of fire, also ballistic performance. When Mauser developed firearms with box-type magazines for clips holding 10 and more rounds of ammunition in the early 1890 s, the dawn of the machine gun was not far off.

Handguns, too, were being subjected to radical changes, though the simple, yet very reliable revolver had dominated the scene for so long. A number of self-loading pistols disappeared almost as abruptly as they had appeared in the first place, viz. Volcanic, Bittner, Schulhof, to mention only a few. Mauser's C 86 also belonged to this group, despite the fact that he had designed an excellent revolver in 1878. However, by the time Bergmann had introduced his first automatic pocket pistol, one might say it was high time that a high-performance military automatic pistol appeared. Today, when judging the merits of these early automatics, one must in all fairness take into account the requirements of the last century. In America and in England's colonies, terrific stopping power via large-size calibres was the only factor worth considering. In Europe, where the soldier was not faced with a horde of enraged Indians or spear-throwing Zulus but mith a civilized opponent at a healthy distance, a smaller calibre of flat trajectory was of greater importance.

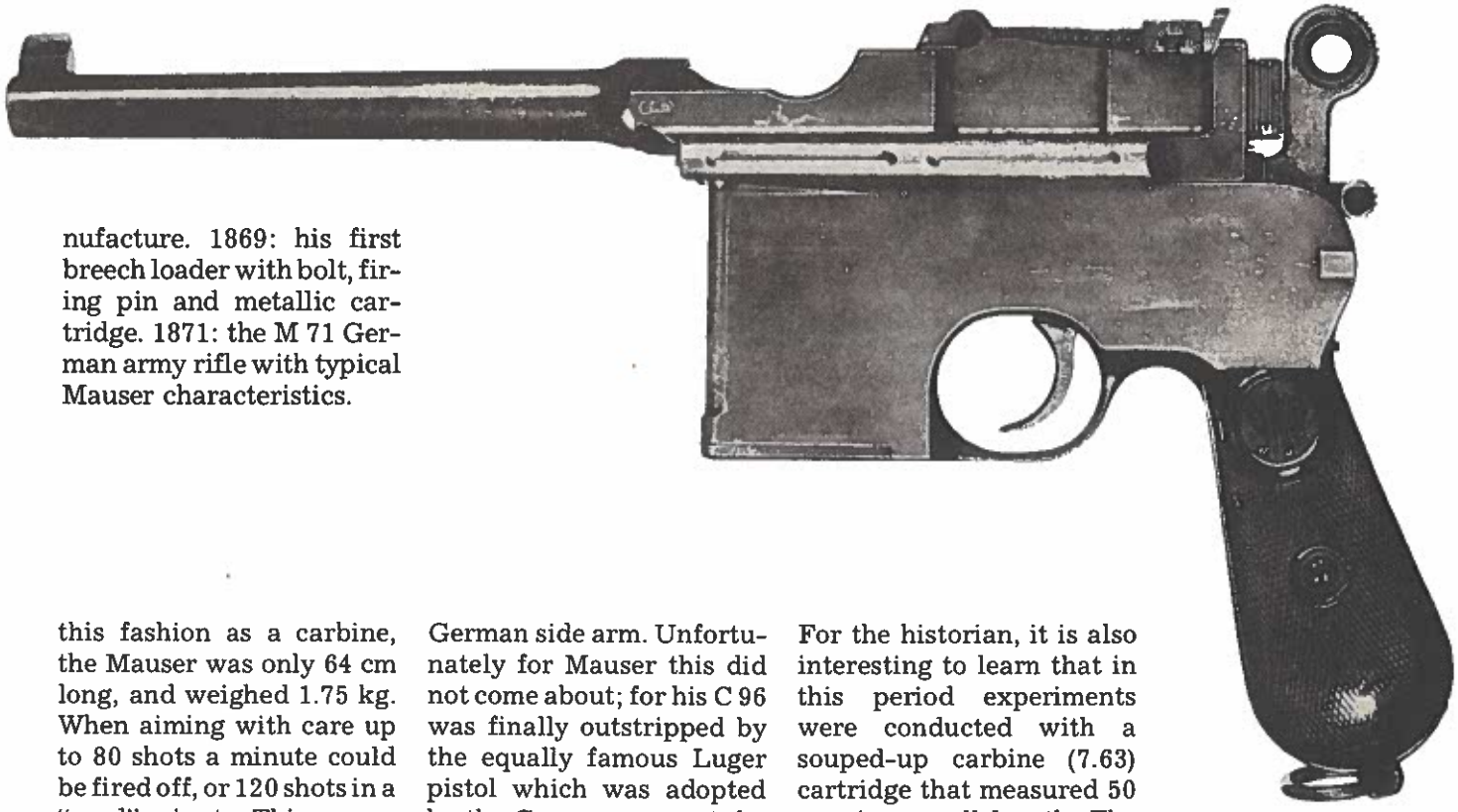
The history of the C 96

The broomhandle mauser is clearly a military pistol in design. It can be loaded with clips of ten rounds, some experimental models with clips of twenty. Its rear sight is adjustable for elevation and is graduated from 50 to 1000 metres. The 7.63 cartridge produces a muzzle velocity of 440 mps, the same velocity attained in the old black powder German infantry rifle (!), and, as far as power is concerned, the 7.63 penetrated 28 cm of pine wood and 3 mm of sheet-steel at point blank range. Which, of course, is very good. And as said before, the trajectory of the 5.5 g jacketed bullet was so flat that the bullet deviated only 6.2 cm at a distance of 100 m. The C 96 was issued with a wooden holster that could be used as a shoulder stock. Used in

Mauser (C 96)

By Roland Karner

nufacture. 1869: his first breech loader with bolt, firing pin and metallic cartridge. 1871: the M 71 German army rifle with typical Mauser characteristics.



2 *The very first Mauser C 96. Hammer has large, round head which obscures the line of sight, unless cocked. Receiver flat without striations. Ebonite grips either checkered or adorned with a flourishy WM = Waffenfabrik Mauser.*

this fashion as a carbine, the Mauser was only 64 cm long, and weighed 1.75 kg. When aiming with care up to 80 shots a minute could be fired off, or 120 shots in a "mad" minute. This proves quite markedly that automatic pistols had the edge on revolvers, at least as far as the military was concerned. However, this did not mean that the trusty revolver had breathed its last; on the contrary, in the non-military sphere it remained very popular. But let us return to 1896! The Gewehr 98, the famous German army rifle, had not yet been introduced, and all countries were in the throes of struggling to find the deadliest, best-functioning "man-killer" of all time.

The C 96 underwent a whole series of experiments and changes, as Mauser was intent on getting this pistol adopted as the official German side arm. Unfortunately for Mauser this did not come about; for his C 96 was finally outstripped by the equally famous Luger pistol which was adopted by the German army at the beginning of this century. The designation C 96 evolves from the word "construction" and the last two digits of the year of construction, 1896. If a weapon was adopted by the German army, the C was replaced by an M (military).

In 1897 there existed the following models of the broomhandle: a six-shot model in cal. 7.63 with fixed rear sight, a ten-shot model in cals. 6 mm and 7.63, a twenty-shot model with integral magazine, and a carbine in cal. 7.63 (removable stock) with 1000 m elevated right sight. This last model could not be used as a pistol, since it lacked a grip.

For the historian, it is also interesting to learn that in this period experiments were conducted with a souped-up carbine (7.63) cartridge that measured 50 mm in overall length. The normal pistol 7.63 measured only 35 mm. The 5.5 g bullet of the carbine cartridge reached a muzzle velocity of 640 mps when fired from a 240 mm barrel, the 9 g version 513 mps. These figures can compare favorably with today's medium-power cartridges, e.g. with the cartridge for the American .30 M 1 Carbine, with the German 7.9 kurz, with the Russian M 43 and the US 5.56 (.223). Mauser's foresight in cartridge design is worthy of our admiration when we consider all the revolutionary technical developments that have taken place over the last 70 years.

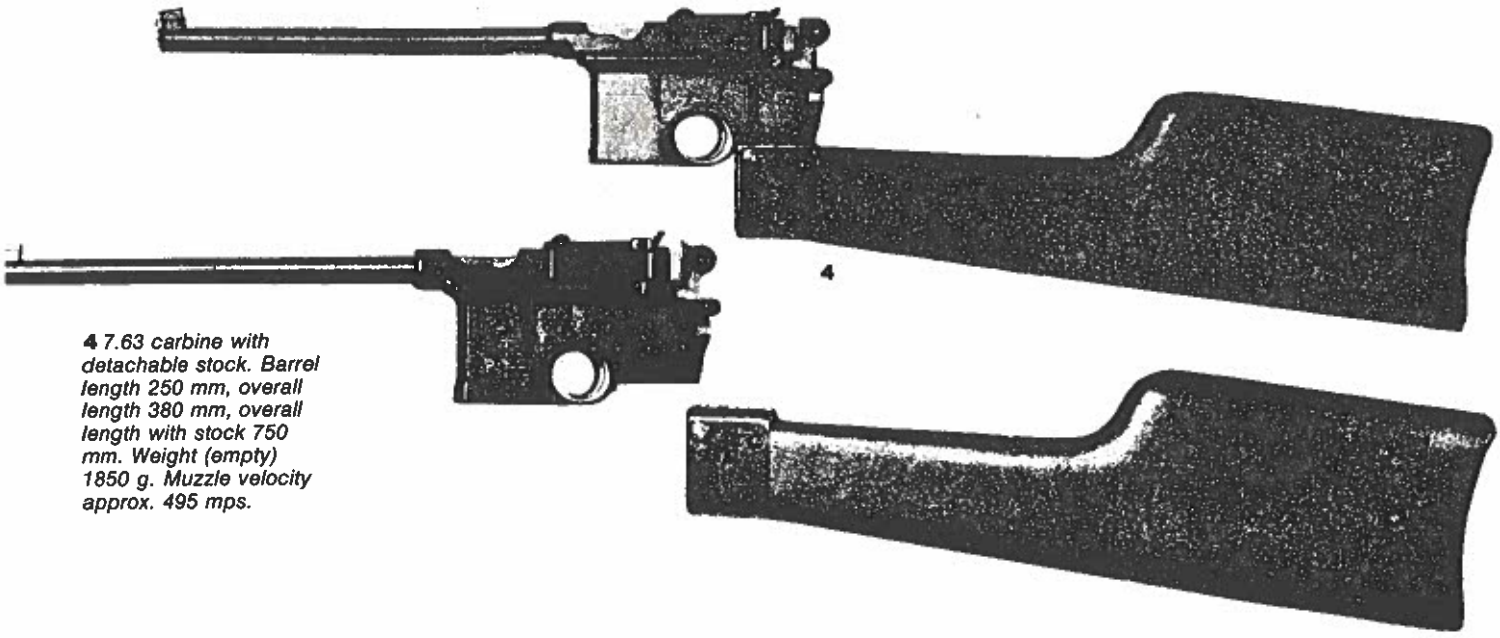
Even though the C 96 has

3 *Loading the C 96. Note in the open bolt the recesses that accommodate the locking link, and the slot in the side of the bolt in which the buffer runs. The protrusion under the rear sight is the housing for said buffer. The firing pin that passes through the buffer can also be seen through the slot in the bolt.*

Winston Churchill with a C 96 in the Sudan campaign, 1898.

been militarily superseded by newer weapons and today is primarily a collector's item, a great number were produced as they were highly valued in many overseas countries. In actual fact, the Chinese copied them in cal. .45 ACP, and the Spanish ASTRA gun plant came out with a close copy. Although Mauser would not have taken kindly to this, imitation still remains the sincerest form of flattery.

In 1932 (Paul had died in 1914 at the age of 76) the Mauser factory introduced the so-called "712" – a machine pistol for fully automatic or single fire with a ten and twenty-shot sheet metal detachable magazine. However, in an age of simple mass production the complicated Mauser design with its numerous milled parts, aside from its questionable use as a military machine gun, could not compete with all the cheaper guns that flooded the market. Nevertheless, the Mauser is a very solidly made pistol, and has won itself a reputation of being reliable, accurate and deadly. Its size, shape and weight prevent its use for the pocket, but in countries where a visible pistol is an adornment to the person wearing it, such as in some Arab states, the Mauser broomhandle is still popular. In fact, the Mauser C 96 saved Winston Churchill's life during the Sudan campaign of 1898. Churchill reported later that he had been ambushed by a horde of mounted natives who were intent on spearing him. "Fortunately for me," said Churchill, "I had possessed myself of one of those new Mauser pistols with a large magazine capacity. I managed to shoot all my pursuers down, and even the last man with the last cartridge!" Despite Churchill's praise and the obvious qualities of the weapon, the German army decided not to adopt it, much to Paul Mauser's disappointment. The C 96 was adopted, however, by Italy and Turkey. During WW 1 the Germans discovered, suddenly, that they had insufficient numbers of the Luger and had to fall back on the C 96 reserves. In 1916 it was decided that cal. 7.63 was not a "man stopper", which occasioned the top brass to have the Mauser produced in 9 mm (para.). As externally both pistols look the same, a (red) figure 9 was carved into the wooden grip plates on both sides of the pistol. Again, there are many Mauser pis-

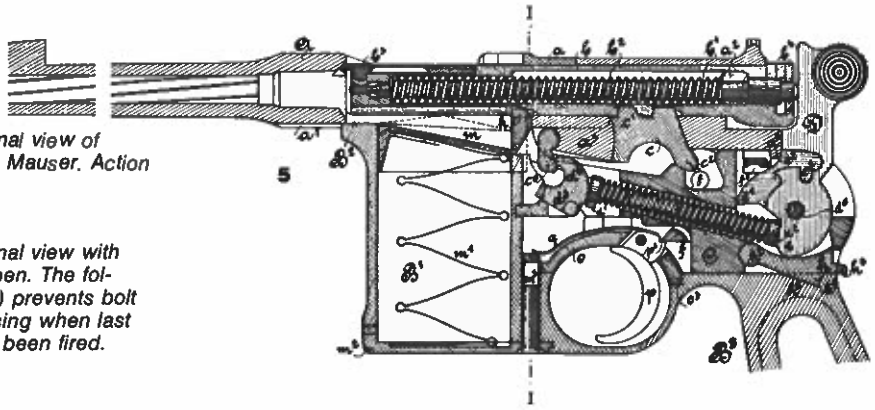


4 *7.63 carbine with detachable stock. Barrel length 250 mm, overall length 380 mm, overall length with stock 750 mm. Weight (empty) 1850 g. Muzzle velocity approx. 495 mps.*

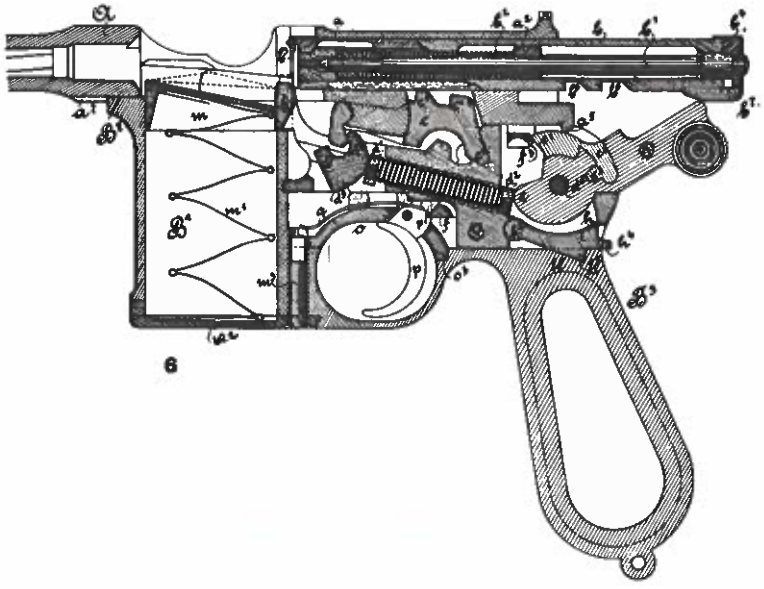
tols that only accept the straight-cased Mauser 9 mm cartridge.

Another outward feature of the 9 mm version is its rear sight, which is only elevated to 500 m. The trajectory of the 9 mm cartridge is not so flat as that of the 7.63 mm. The popularity of the broomhandle with the German troops during WW1 influenced the Luger in two respects. The Luger, too, was fitted with a longer barrel, an elevated rear sight graduated to 800 m, and a detachable shoulder stock. On top of this the Luger was then issued with a 32-shot drum magazine, known to the Americans as, "the snail".

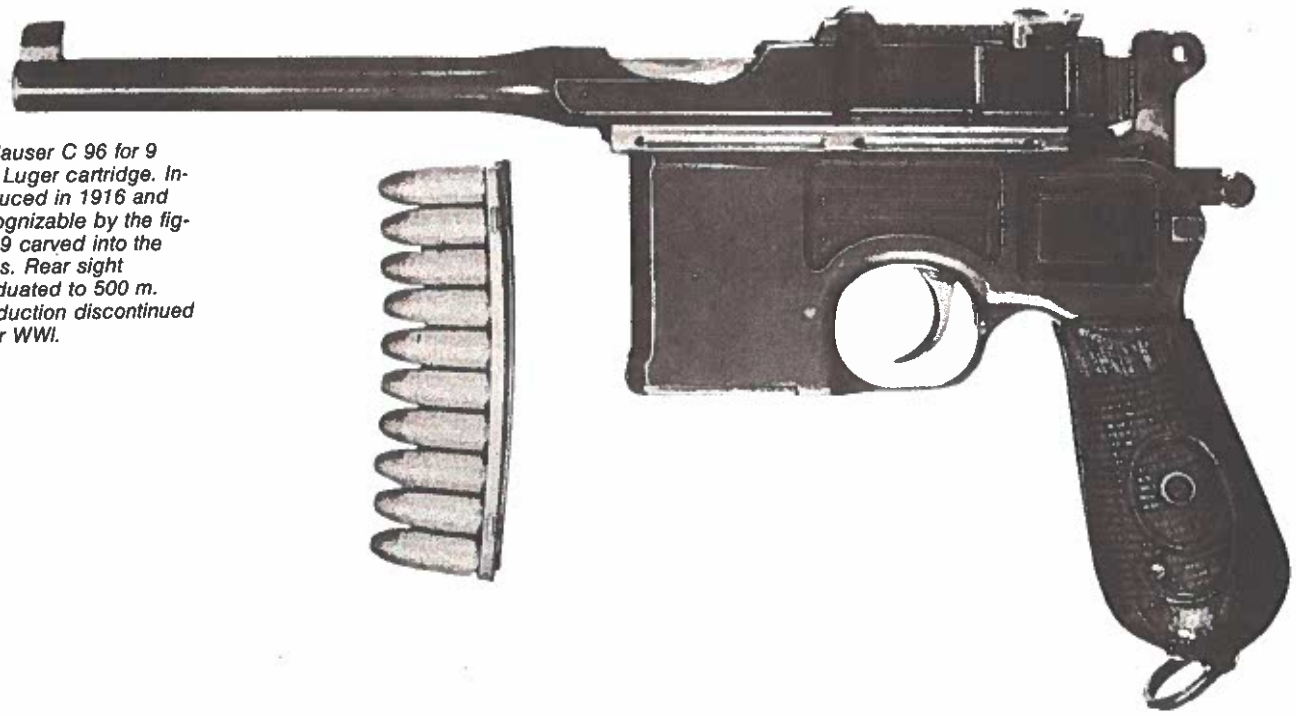
Even in WW II Hitler was forced to fall back on the obsolescent C 96s, and other weapons of yesteryear. This had its advantages, though, for the Ger-



5 *Sectional view of the 1896 Mauser. Action closed.*



6 *Sectional view with action open. The follower (m) prevents bolt from closing when last shot has been fired.*



7 *Mauser C 96 for 9 mm Luger cartridge. Introduced in 1916 and recognizable by the figure 9 carved into the grips. Rear sight graduated to 500 m. Production discontinued after WWI.*

mans made good use of the Russian 7.62 cartridge, which fitted their Mauser 7.63.

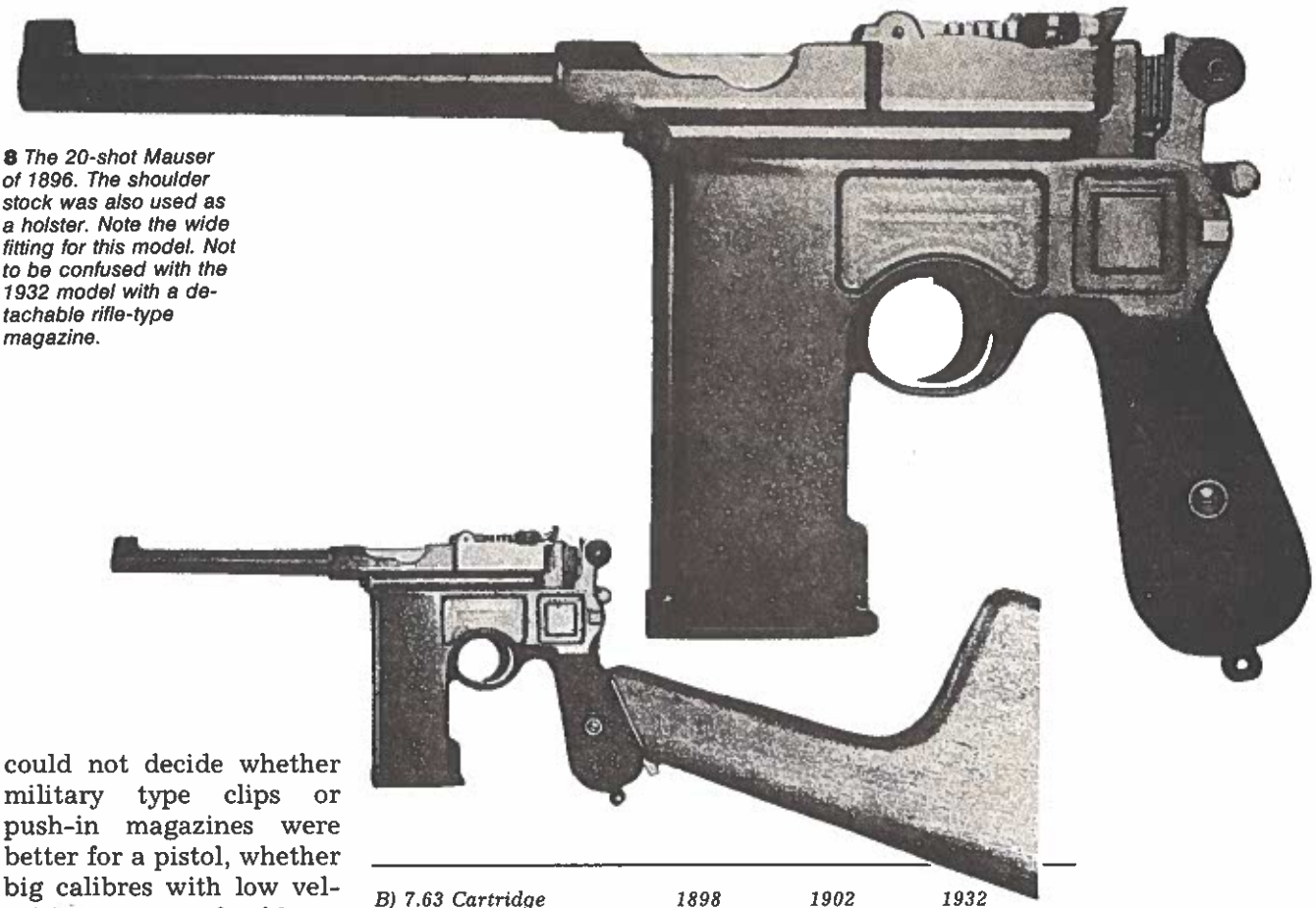
After WW1 the terms of the Treaty of Versailles provided that Germany give up its colonial possessions, be stripped of its submarines, its army (apart from 100,000 men) and be prohibited from manufacturing instruments that could be interpreted as tools of war. In time the Germans conceived a number of dodges to bypass these restrictions. The C 96, for example, was fabricated with a 10 cm shorter barrel, thus qualifying it as a 'weapon of defense' for export. That so-called export model became a favorite with the Bolshevists in Russia and this shortie is a prized collector's item today. Another eye-catching feature is the shape of the wooden grips. They have a sort of bevelled ledge at the top end, whereas the grips of the normal model taper off completely.

Furthermore, these grips, which are also more angular than others, also appeared on the 1902 model. Interestingly enough, the 1902 also had a short barrel, a model we will describe at a later point.

During this period a lot of experimentation was carried out, for the experts

A) Pistols	1896 model [1]	1902 model [2]	1932 model (712)
Overall length (mm)	290	260	288
Overall length with shoulder stock (mm)	630	600	628
Height (mm)	150	100	132
Maximum width (mm)	35	30	35
Barrel length	140	100	138
Diameter of bore (mm)			
– across lands	7.63		
maximum	7.68		
– across grooves	7.87		
maximum	7.92		
Length of rifling (mm)	102		
Number of grooves	4 (right hand)		
Length of twist (mm)	240		
Breech and lock length (mm)	6	3	6
Weight (empty) (g)	1180	1080	1240/1285[3]
Length of shoulder stock (mm)	360		
Maximum with (mm)	45		
Weight (g)	440	400	440

1) *10-round version*
2) *Light-weight model tested in 1902 is very similar to 1920 SHORT Mauser*
3) *10 and 20-round magazines*
4) *1896! Improved ballistics since then!*
5) *In 1902 a new explosive based on guncotton was tested.*



8 *The 20-shot Mauser of 1896. The shoulder stock was also used as a holster. Note the wide fitting for this model. Not to be confused with the 1932 model with a detachable rifle-type magazine.*

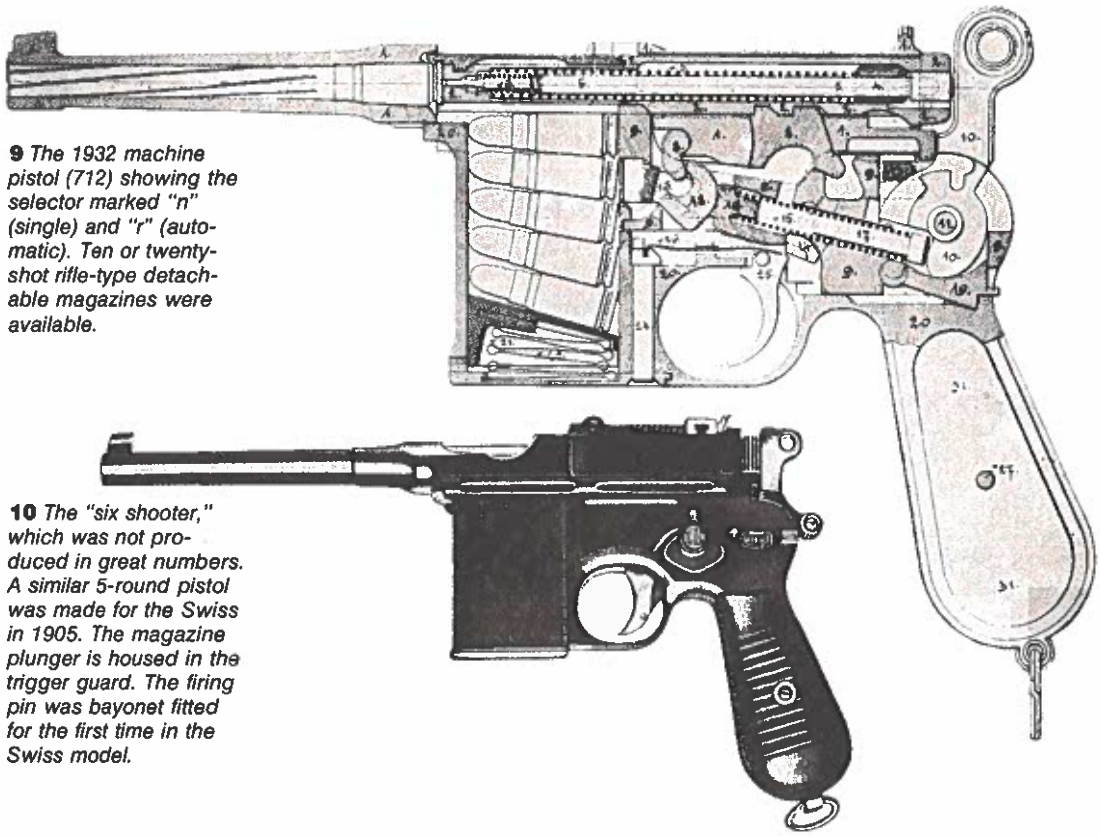
could not decide whether military type clips or push-in magazines were better for a pistol, whether big calibres with low velocities were preferable to small calibres with high velocities, whether a handgun should have an outside hammer, whether double action is better than single action, etc.

To increase exports to primative countries, areas where stopping power was of prime importance, a straight-cased 9 mm Mauser cartridge was introduced. This is 4 mm longer than the 9 mm Luger and is extremely powerful, comparable to the 9 mm Bergmann, 9 mm Steyr and .38 Auto Colt.

The way the C 96 works

Fig. 1 shows a sectional view of one of the very first models of the C 96. A

B) 7.63 Cartridge	*1898 model[1])*	*1902 model[2])*	*1932 model (712)*
Length of cartridge (mm)	*35.0*		
Length of case (mm)	*25.0*		
Length of bullet (mm)	*13.8*		
Weight of cartridge (g)	*10.7*		
Weight of case (g)	*4.7*		
Weight of bullet (g)	*5.5*		
Weight of powder (g)[4])	*0.5*		
Max. bullet Ø (mm)	*7.82*		
Muzzle velocity (mps)[4])	*425*	*400*	
at 100 m	*336*		
at 500 m	*196*		
at 1000 m	*115*		
Muzzle energy (mkg)	*50.6*	*44.9*	
at 100 m	*31.6*		
at 500 m	*10.8*		
at 1000 m	*3.7*		
Max. gas pressure (kp/cm²)	*2168*	*1630[5])*	
Trajectory (cm), mid-range			
at 100 m	*6.2*		
at 200 m	*39.5*		
at 300 m	*111.2*		
Penetration (point blank)			
Sheet metal (mm)	*3*	*3*	*3*
Soft wood (mm)	*260-280*	*250*	*260-280*
Rate of aimed fire incl. loading, per min.	*60-80*		
Mad minute	*120*		
Cyclic rate of fire (per min.)			*900-960*
Spread after firing 10 shots (cm)			
at 100 m	*11x 15*		
at 200 m	*20x 25*		
at 500 m	*135x150*		



9 *The 1932 machine pistol (712) showing the selector marked "n" (single) and "r" (automatic). Ten or twenty-shot rifle-type detachable magazines were available.*

10 *The "six shooter," which was not produced in great numbers. A similar 5-round pistol was made for the Swiss in 1905. The magazine plunger is housed in the trigger guard. The firing pin was bayonet fitted for the first time in the Swiss model.*

number of parts were redesigned in later models. Barrel (A) and barrel extension (a) are of one piece, including sights, or base of elevating sight. The barrel extension (a) houses the bolt (b) which contains at its front end the extractor (b3), in its longitudinal shaft is the firing pin (b1) and firing-pin spring, as well as the recoil spring (b2). Rib (b4) secures firing pin (b1). When the bolt mechanism travels rearward the recoil spring (b2) is compressed against the buffer (a2) through which the firing pin (b1) passes. The top part of the receiver (B) is fitted with a groove on each side to accommodate the barrel extension (a).

When the pistol is fired bolt (b) and barrel assembly (Aa) are locked together via the link (c), the double head of which engages in the recesses on the underside of the bolt. When gas pressure in the chamber has dropped to safer limits and barrel assembly (Aa) and bolt (b) have travelled rearwardly about 6 mm, link (c) disengages from the recesses in the bolt. Once disconnected, the bolt (b) can continue on its rearward journey alone. The tail of the barrel extension (a5) impinges on the base of the hammer (D), initiating the rotation (cocking) thereof. The bolt (b), which continues further to the rear than does barrel extension (a), overrides the partially cocked hammer (D), hence cocking it completely.

The spent cartridge case is removed in the normal manner via the extractor (b3) and is flicked out of the pistol upon contact with the ejector (k), the head of which runs in a cutaway on the underside of the bolt (b).

The magazine well (B1) houses two staggered rows of cartridges which are fed vertically by means of the follower (m) and the follower spring (m1). When the bolt (b) returns under spring pressure it strips off the top cartridge from the magazine and rams it into the firing chamber. During the return movement of the bolt (b) the link (c) is lifted out of the recess of the lock frame (C) to re-engage in the recesses of the bolt (b); thus locking the breech for the next shot. The tail of the barrel extension (a5) prevents the hammer from reaching the firing pin (b1), should the breech not close properly.

The hammer (D), when cocked, is held by the sear

(f3). When pulling the trigger (p) the trigger extension (p1) revolves around its axis, camming the disconnector (f) out of engagement. This precaution prevents the pistol from firing full-automatic like a machine gun. When the sear (f3) is lifted out of engagement with the hammer (D) the hammer is forced downwards by the mainspring and plunger (d2), whereby the rocker plunger (d1) exerts pressure against the rocker (d3) which in turn engages with the abutment (c4) to assist closing and locking the breech.

The lock frame (C) accommodates the hammer (D), hammer axle (d6), the mainspring and plungers (d 1 and d 2), the disconnector (f), the rocker (d3), the safety (not shown) and frame stop (h) which holds the lock frame and associate parts securely in the receiver. When stripping the pistol, the outside lip (h4) of the lock frame is forced up with the tip of a screwdriver or with the end of the ammunition clip. As seen in the illustration, the frame stop (h) can only be lifted when the hammer is cocked.

When the last shot has been fired the magazine follower (m) holds the bolt (b) open. To re-load, the ammunition clip is inserted into its appropriate slot, the cartridges then being thumbed down into the well of the magazine. The moment the now empty clip is removed from its slot the bolt (b) closes and chambers the first cartridge; the extractor (b3) snapping into the cannelure that encircles its base.

The working parts of the C 96 are jigsaw-puzzle fitted, there is a conspicuous lack of screws and loose pins. The first model of 1896, as shown in our sectional drawing Fig. 2, used an axle-pin for the trigger and for the tilting frame of the graduated rear sight.

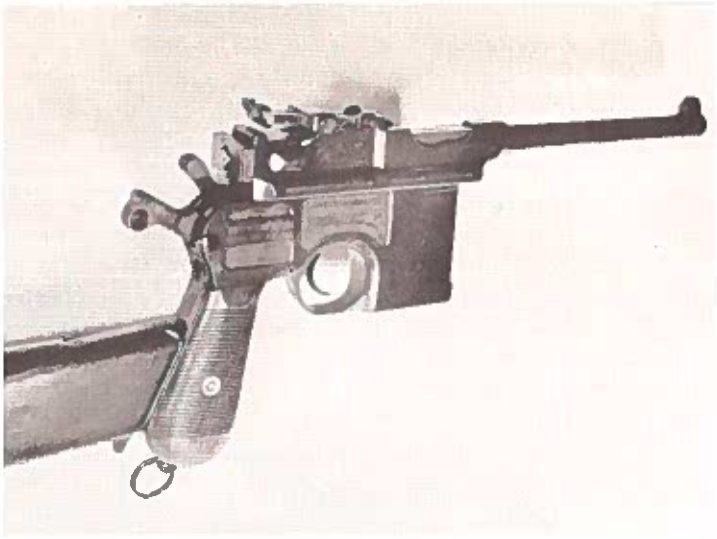
In the 1902 model, however, these two pins were replaced by milled out axle ends. The hammer axle (d6) is not a simple pin, it has two spring arms that exert pressure on the sear (f3) and frame stop (h). The only screw in the whole pistol is the one that holds the wooden grips to the handle. These features are part of its military conception; whereby the soldier can disassemble the pistol without a screwdriver, punch, or other tools. The soldier can strip the pistol completely with aid of the ammunition clip and the nose of a bullet. Contrary to modern automatics, the grips of the broomhandle do not have to be removed to get to the working parts. As with the Gewehr 98, a cartridge is used to remove the magazine floorplate of the C 96. Furthermore, a cartridge can also be used for removing the rib (b4) to get the firing pin (b1). However, this otherwise well designed pistol did have one weakness, its disconnector. If the trigger was not energetically depressed, the rest of the cartridges would fire off in machine gun fashion. This, of course, was dangerous and had to be remedied in the 1902 model. This was achieved by seperating the sear from the trigger in such a way that the sear automatically returned to its locking position irrespective of whether the shooter pulled the trigger vigorously or squeezed it gingerly. As seen in Fig. 3, only three flat springs were used in the later models: for the trigger, the rear sight, and the magazine follower. The ones in the hammer axle are so minute that they need not be counted. All others are wire springs, very progressive for a gun of 1896!

▲ *Mauser factory at Oberndorf, Germany*

Improved 1902 Model

When in 1902 approx. 40,000 C 96s had been sold, attempts were made to remedy the weak points that had shown up. Mention has already been made of the inadequate disconnector, of the discontinuation of the loose pins for rear sight and trigger axles, and of the trigger retaining plate. The firing pin was also simplified in that it was bayonet fitted in the breech bolt, rendering the retaining rib superfluous. Differences in dimensions, weight, and in ballistic performance can be gathered from the table. In the 1896 model, to apply the safety, the catch had to be turned only 12 degrees around its axis. This distance between "sicher" and "feuer" was increased to 60 degrees in the 1902 model. Beyond that these words for "safe" and "fire" were replaced by a conspicuous S and F.

11a



11b

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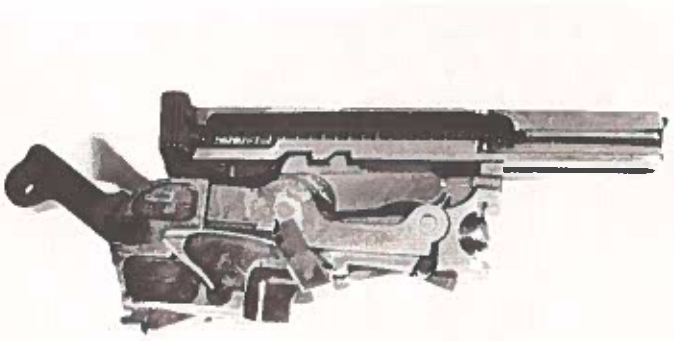
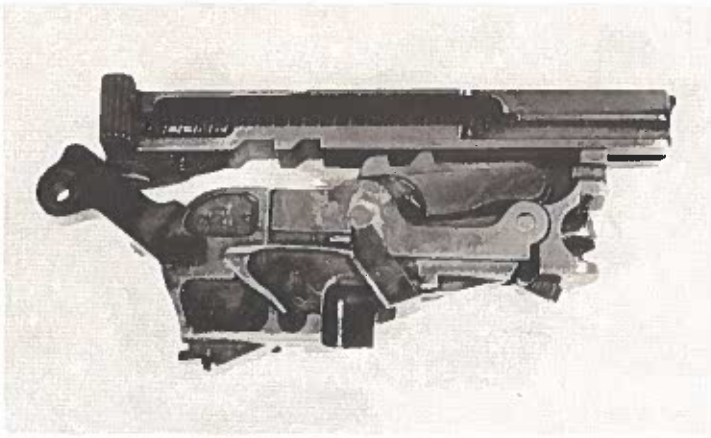


The safety can be applied both when the hammer is cocked or in the down position. Since on previous models it was necessary to pull back the hammer with one hand and engage the safety with the other, an interesting "link safety" was devised. This, however, never left the experimental stage and is today a curiosity for gun collectors. The hammer lacked the usual serrated thumbpiece as it was to be cocked via the safety catch, a method permitting cocking and decocking without fear of the hammer touching the firing

11a *Top: The C 96 with attached shoulder stock, cocked with safety applied, rear sight graduated to 500 m.*

11b) *Center: The Mauser field stripped.*

12 *Bottom: Here the recoil spring can be seen in the bolt. The link is engaged in the recesses of the bolt, and the action is ready for firing.*



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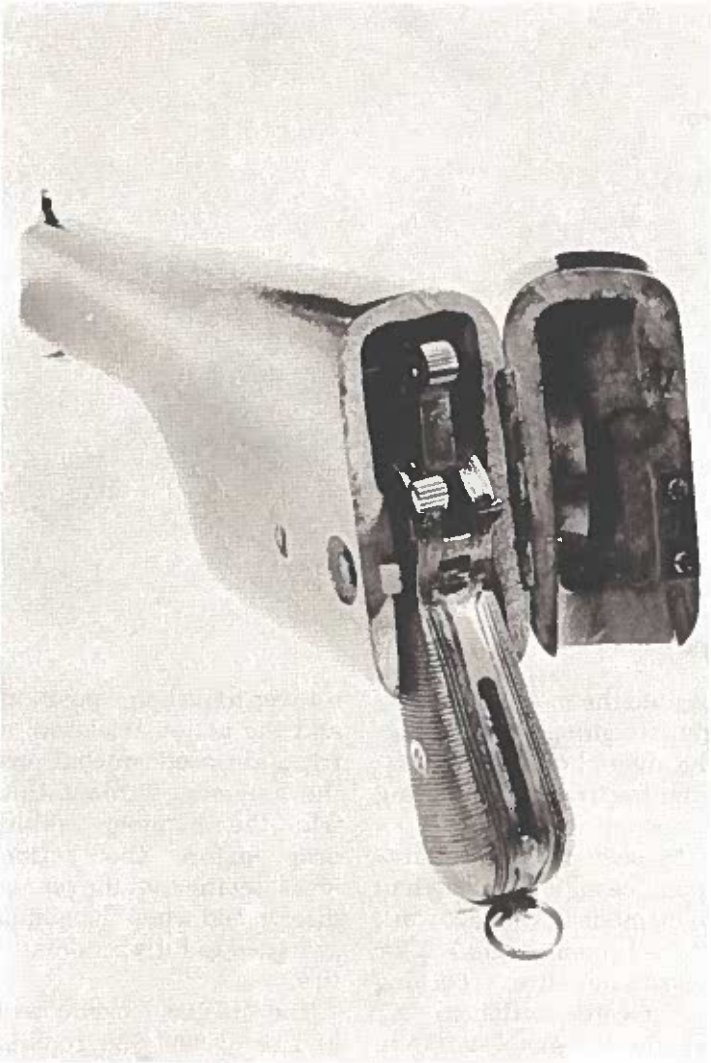


14

13 *Top: Action has been fired, whereby the link has disengaged from the bolt and is lying in the cavity of the lock frame. Hammer is re-cocked by the rearward sliding bolt.*

14 *Bottom: The Mauser in its wooden holster. A flat spring inside the slide prevents gun from rattling. Note groove in pistol handle for attaching shoulder stock, also the lip of the lock frame below the hammer.*

pin. In other words, this was the forerunner of the universal safety of 1930, built into pistols from No. 800,000 onwards. On the backstrap of the hammer are the initials "NS" (new safety). From now on the safety could be applied with one hand only.

The hammer can be safely lowered on a chambered cartridge when the safety is applied; particularly useful when wearing thick gloves or when one's hands are frozen in winter. A cam on the safety prevents the hammer from reaching the firing pin. Even with the trigger depressed a cartridge can be chambered without the hammer falling, owing to the disconnector. If a revolver goes off while one's thumb is on the hammer no damage is done; unless the gun is pointing in the wrong direction! This is not so with an automatic pistol, for the barrel assembly, and, above all, the bolt (slide) flys to the rear; damaging or easily breaking a hapless shooter's thumb. You will understand now why so much effort has been made to degoof cocking operations on automatic pistols.

Imitations of the C 96

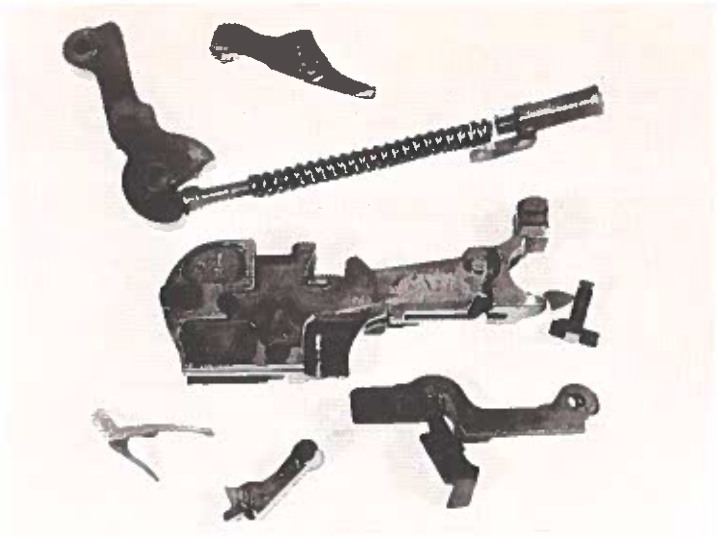
The broomhandle Mauser was undoubtedly a pioneering feat in the field of locked action automatic pistols. It is not surprising, therefore, that its design has found many imitators.

The best known copies of the C 96, qualitatively speaking, must be the Spanish ASTRA models 900 to 903. Externally, the ASTRA is indeed very similar, but internally it has a design of its own, simpler than that of the Mauser. The ASTRA 901 takes both a 10 and 20-shot detachable magazine, and is equipped with a selector for single and fully automatic fire. Eulogio Arrostgui of Eibar, also introduced an imitation under the name of Azul, which, like ASTRAS, were exported to Asia and South America.

Imitations with Chinese markings were often brought home by the veterans of the Korean war. These, however, have nothing to do with those models originally exported to China bearing the genuine Mauser inscription plus Chinese markings.

Due to the numerous imitations of inferior quality, during the 1930s the firm of Mauser felt induced to market a new model basically identical with the C 96 but equipped with a universal safety and a detachable 10 or 20-shot box-type magazine. The controversial question as to whether a push-in magazine or loading clip is preferable, was decided in favor of a magazine and loading clip!

Model 712 (1930) was fitted with a selector for single and fully automatic fire, to compete with the imitations offering this feature. In reality, automatic fire is beyond the scope of a handgun weighing only 1745 g; the amount of muzzle jump after the first bullet making it uncontrollable.



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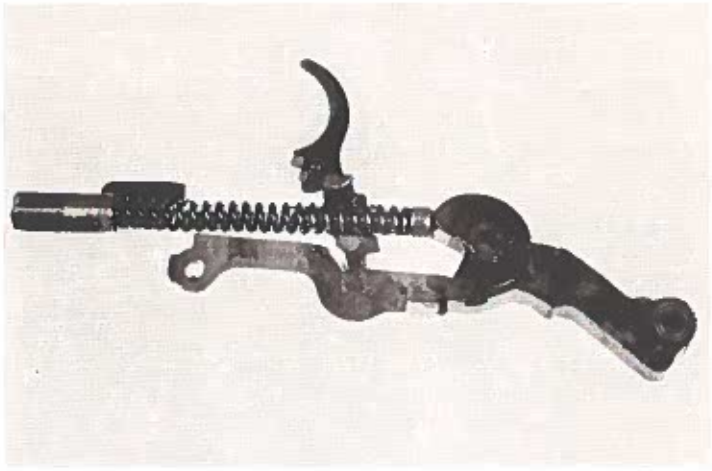
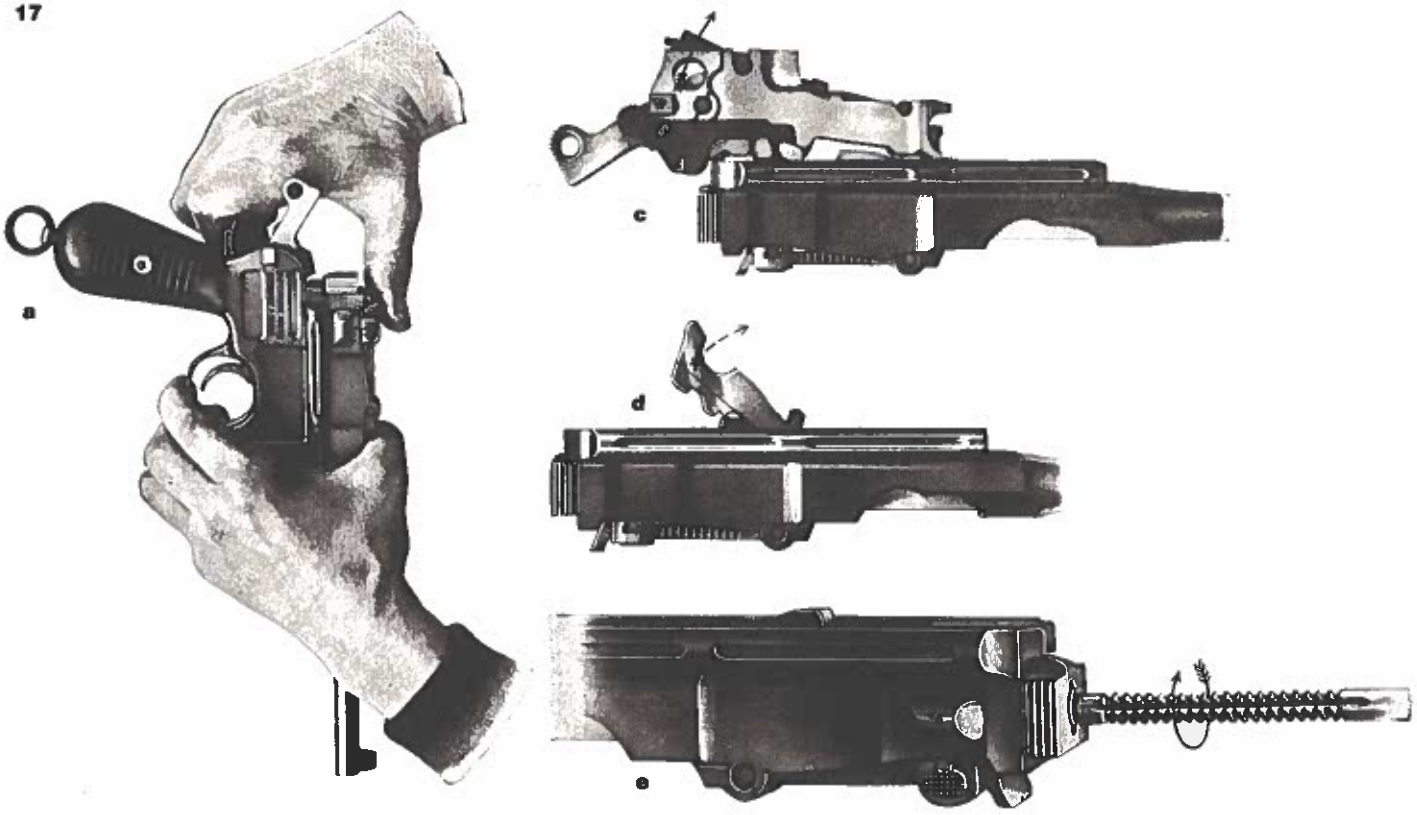


16

As seen in the illustrations, certain changes had to be made in the lockwork of the broomhandle 712 for automatic fire. Turning the selector switch to "N" (single) the pistol works in the normal fashion. When turned to "R" (auto) the sear arm is held permanently out of engagement with the hammer as long as the trigger is depressed. As soon as the barrel extension returns to its home position and the action is closed, a trip is released which drops the hammer. Without this trip the hammer would drop before the action locks, seeing that the sear is disengaged when the gun is switched to fully automatic fire.

The 712 has a cyclic rate of fire of 900-960 rounds per minute, which means 15-16 rounds per second! In other words, a magazine of 20 shots would be emptied in one burst lasting only 1.3 seconds. Even when the shoulder stock is attached

17



15 *Top left: Main parts of the action. Note no loose pins are used.*

16 *Bottom left: The cocked hammer, trigger, mainspring, sear and disconnector.*

17*a) To field strip the broomhandle, cock the hammer and press up the lip of the lock frame with a screwdriver or cartridge clip.*

b) Slide out to rear the barrel assembly with lock mechanism.

c) Lift lock mechanism clear of the barrel extension as indicated by arrow.

d) Now swing out the link.

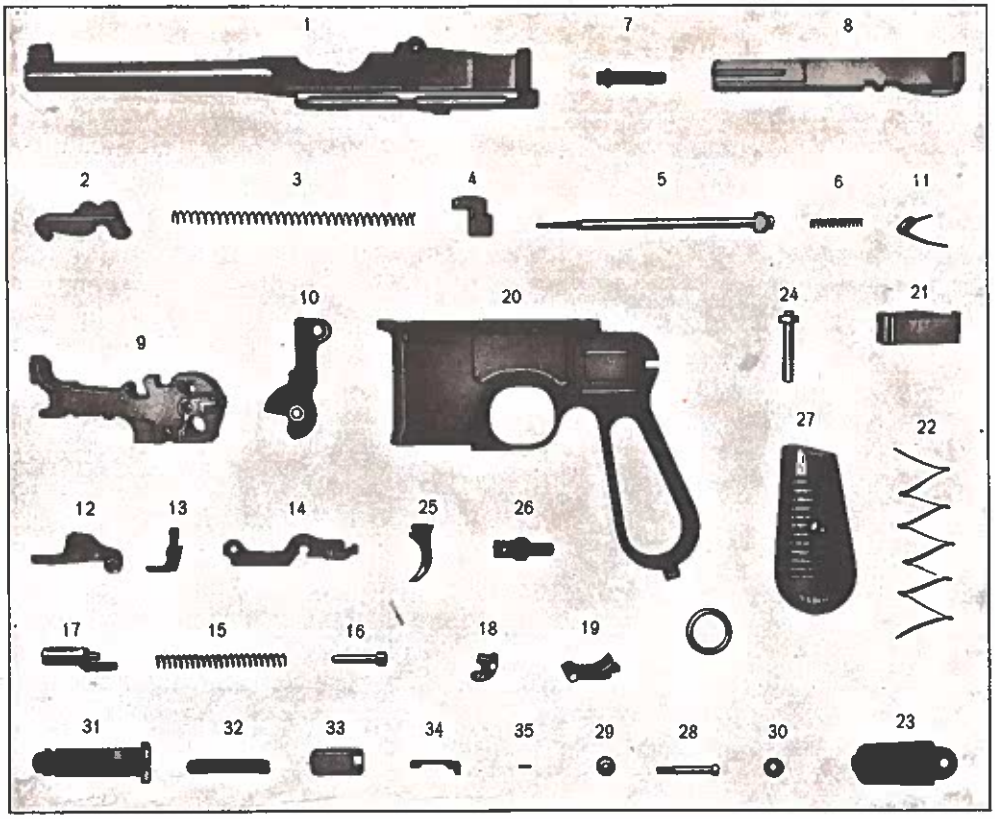
e) The firing pin is held in the bolt by a two-lug bayonet mount. Place a screwdriver in the slot, depress slightly and turn 90 degrees. (In illustration a cleaning rod is being used).

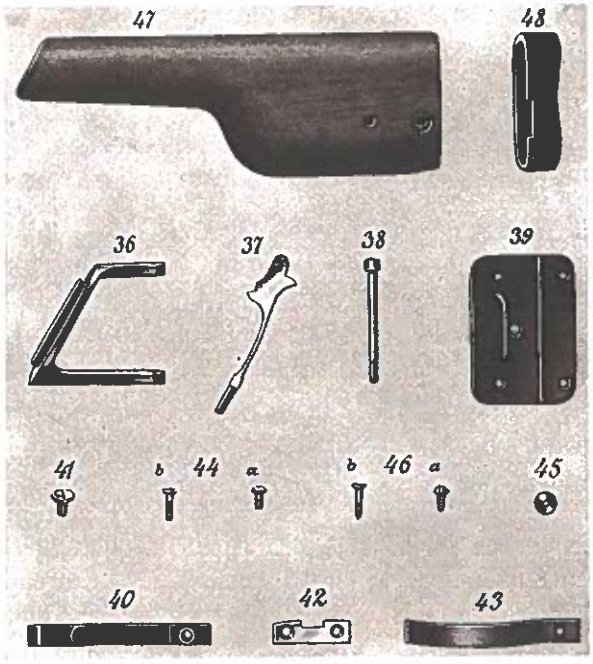
muzzle jump makes the gun, at best, erratic. Militarily speaking, there are perhaps moments when a machine pistol can get one out of a tight spot, otherwise the 712 simply wastes ammunition.

However, the new Russian APS pistol, designed by Stetshkin, follows very closely in the footsteps of the 1932 Mauser machine pistol, even to the extent of possessing a wooden holster that can be used as a shoulder stock. The muzzle energy of the 7.63 Mauser is 50.6 mkg, and even more with modern cartridges,

Parts legend (Mauser 1912)

1. *Barrel and barrel extension*
2. *Link*
3. *Recoil spring*
4. *Recoil spring stop*
5. *Firing pin*
6. *Firing pin spring*
7. *Extractor*
8. *Bolt (breechblock)*
9. *Lock frame*
10. *Hammer*
11. *Hammer axle*
12. *Safety catch*
13. *Disconnector*
14. *Sear arm*
15. *Mainspring*
16. *Mainspring plunger*
17. *Rocker plunger*
18. *Rocker coupling*
19. *Lock frame stop*
20. *Receiver*
21. *Magazine follower*
22. *Magazine spring*
23. *Magazine floorplate*
24. *Magazine plunger*
25. *Trigger*
26. *Trigger spring*
27. *Grip*
28. *Grip screw*
29. *Grip screw nut*
30. *Washer*
31. *Rear sight*
32. *Flat spring for above*
33. *Rear sight slide*
34. *Rear sight leaf*
35. *Spring for above*

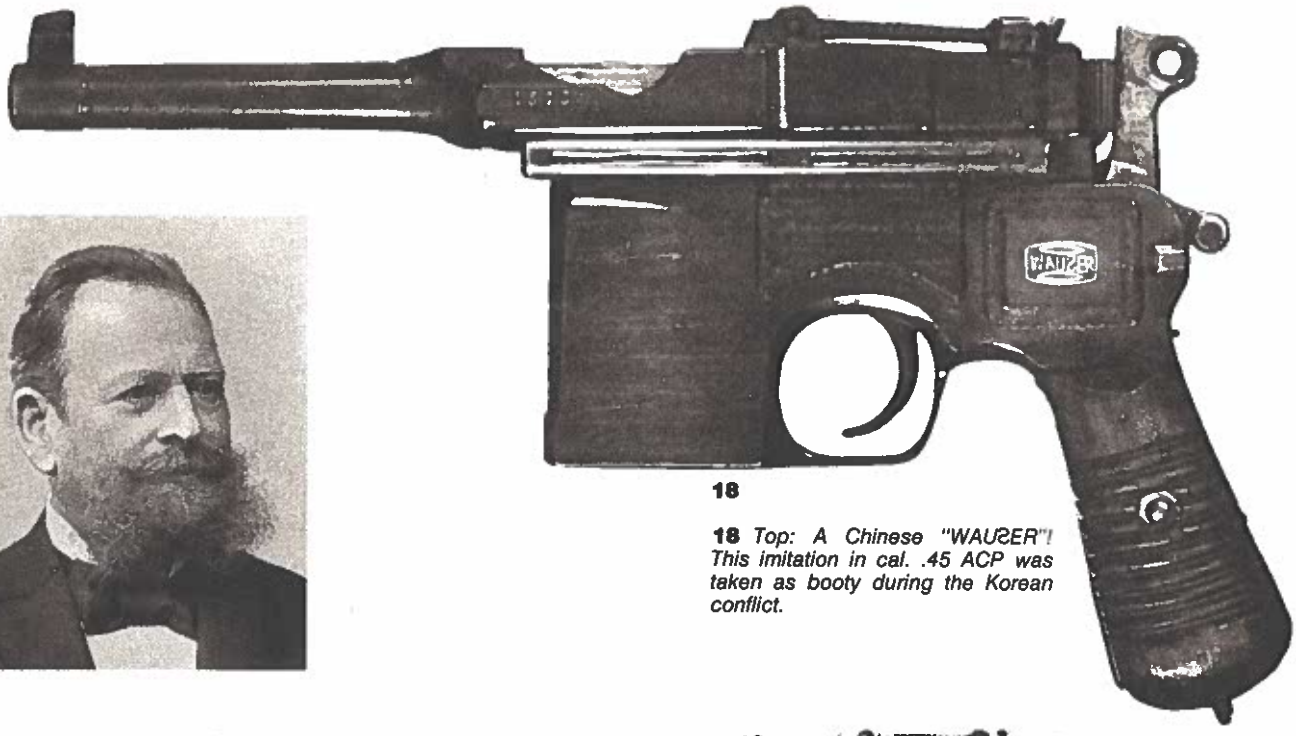




Parts legend (shoulder stock)

36. *Support*
37. *Spring for above*
38. *Support screw*
39. *Hinge*
40. *Latch*
41. *Screw for above*
42. *Latch plate*
43. *Buffer*
44. *a) Short screw for hinge plate*
    b) Long screw for hinge plate
45. *Nut for the above screws*
46. *a) Piano-head wood screw*
    b) Countersunk wood screw
47. *Shoulder stock/holster*
48. *Lid for above*

whereas the new APS only achieves 30 mkg with a similar cartridge. This is partly due to the fact that the APS is a normal blow-back design with no locking system incorporated to check escape of gas from the breech. There is no denying that the Mauser, a weapon basically 70 years old, is still influencing today's gun designers. The broomhandle's reputation of being absolutely reliable is not solely due to its design, though. The materials it is made of are of such high quality that even after 100,000-shot endurance tests no appreciable wear on any parts could be ascertained. Let me give a typical example: The tail end of the firing pin, though provided with a slit for removal with a screwdriver, shows no



18

18 *Top: A Chinese "WAUZER"! This imitation in cal. .45 ACP was taken as booty during the Korean conflict.*

18a *A Spanish imitation*

signs of burrs, despite the fact that the hammer strikes against this area with full force. The 1932 machine pistol was the last of the broomhandle series. Superceded by the 9 mm Luger, and 9 mm Walther P 38 in its experimental stage, the high cost of production and the outbreak of WW2 put a stop to further developments; although the Mauser was used in two world wars and on many continents.

In Germany, Mauser was granted the following patents:

1. DRP 90 430 of Dec. 11, 1895, covering the general system of a self-loading mechanism and the special design of the Mauser pistol.
2. DRP 142 359 of May 30, 1902, covering the experimental safety described in the article but which was not mass produced.
3. DRGM 75 915 of May 18, 1897, covering the rear adjustable sight with its spring attachment.
4. DRGM 59732 of July 23, 1896, covering the shoulder stock which can be used as a holster.

Broomhandle Mauser (C96)

19 *The Spanish ASTRA*

20 *The 712 Mauser machine pistol. Note 10 and 20-shot magazines.*

References: R. Wille, "Mauser-Selbstlader" Berlin, 1897 (Eisenschmidt). R. Wille, "Selbstlader-Fragen" Berlin, 1902 (Eisenschmidt).

R. H. Korn, "Mauser-Gewehre und Mauser-Patente" Berlin, 1908 (Eckstein).

Johnson/Lockhoven, "International Armament" Vol. 1 Cummings International Associates Technical Publication, Cologne, 1965.

Additional parts for the 712 machine pistol. The catch hook (13398) works in conjunction with the sear arm and a slot in the rear of the bolt to trip the hammer only when the action is firmly locked, i. e. when the pistol is on "automatic."

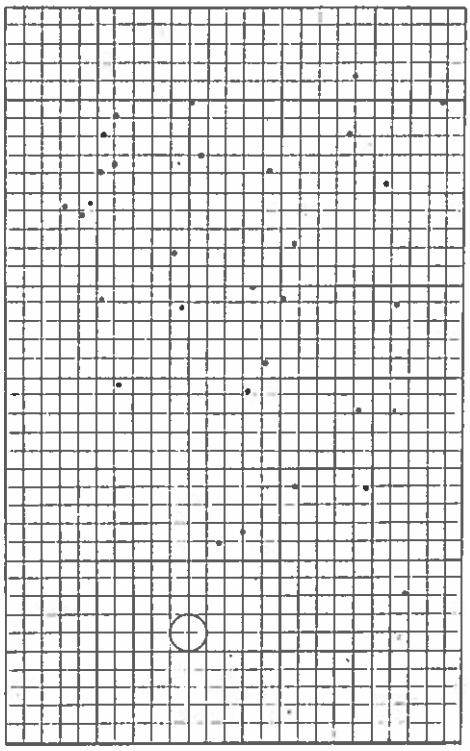
Spread at 1000 metres Oberndorf, June 17, 1896, 30 shots.

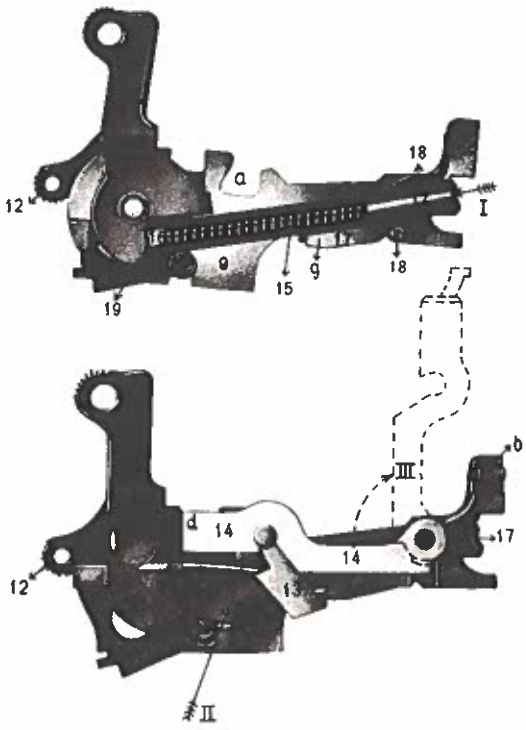
Vertical dispersion: 5.65 m
Lateral dispersion: 4.15 m

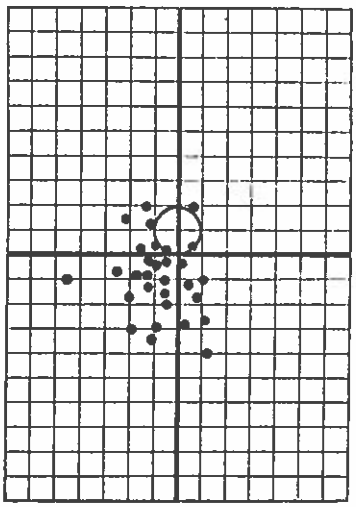
Scale = 1:66.6

Large squares = 1x1 m
Small squares = 20x20 cm

Wind speed: 1–3.5 m per second



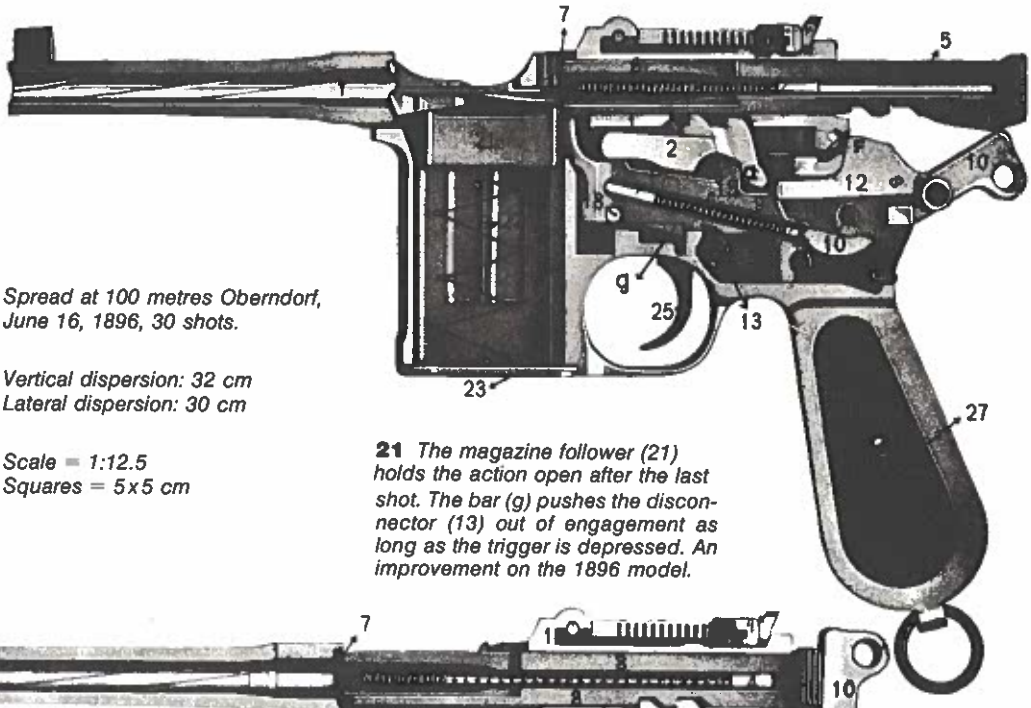




Spread at 100 metres Oberndorf, June 16, 1896, 30 shots.

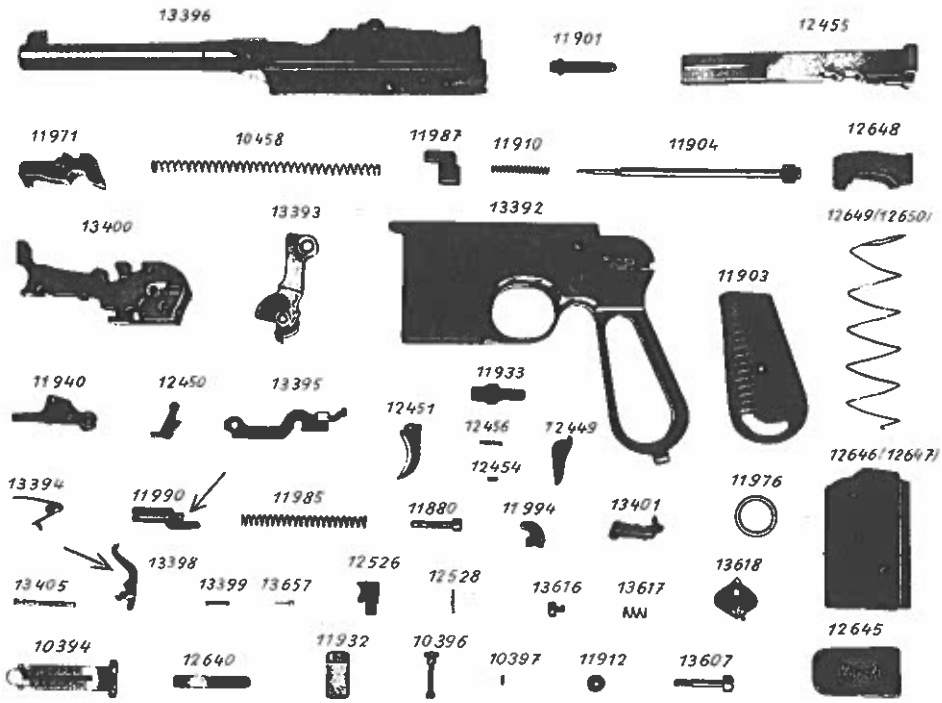
Vertical dispersion: 32 cm
Lateral dispersion: 30 cm

Scale = 1:12.5
Squares = 5x5 cm



21 *The magazine follower (21) holds the action open after the last shot. The bar (g) pushes the disconnector (13) out of engagement as long as the trigger is depressed. An improvement on the 1896 model.*

22 *Sectional view of the 1912 broomhandle. Note that link is engaged in the bolt recesses, and that all loose pins have been done away with.*



Peter Reitmair on

The Au

Although at the beginning of the second half of the 19th century a number of serviceable breech loading rifles were available, their usefulness as military weapons was disputed by the experts of most armies. Conservatism on the one hand, plus the expense of re-tooling on the other (apart from the fact that the percussion muzzle loader of the time was adequately accurate) proved determining factors.

strian Breech Loader M 67

Infantry & jaeger rifle

During the period under discussion, the Prussian Army was the only force completely equipped with breech loading rifles, viz. with the battle-proved Dreyse needle rifle of the Danish campaign. The other European states, including Austria-Hungary, played wait-and-see and convened "breech loader commissions" to report on the latest developments. However, these commissions limited their observations to the comparison of ballistics between the two systems. Seeing that the muzzle loaders had reached the apex of their many years of development and were designed to fire expansion bullets, it is not surprising that they beat these new-fangled breech loaders, at least ballistically speaking, hands down.

However, the two main advantages of the breech loading system were thoroughly underrated by the experts of the time. The breech loaders could deliver a higher rate of fire, and were also ideal for the new military tactic of employing cover-up fire. The Austrian gun commission in Vienna summed

Troops advancing on Sarajevo. A scene taken from the 1878 campaign in Bosnia and Herzegovina.

the situation up as follows when war was imminent between the two states:

"The Dreyse rifle of the Prussians has too short a range and is too inaccurate. It is complicated in design and extremely susceptible to stoppages. Moreover, its rapid loading system induces the soldier to fire away indiscriminately, thus demanding a constant supply of fresh ammunition."

It was true that the Austrian muzzle loader, M/1854 (Lorenz), shot further with its expansion bullets and was more accurate than the Prussian needle gun, but in view of the new military tactics on the front whereby riflemen no longer stood in straight lines, the breech loader was the more modern of the two weapons systems.

On the Italian front, both the Austrian and Italian antagonists fought with muzzle loaders, and at Custozza the Lorenz proved once again that it was the finest muzzle loader of all time – a few days before the famous battle of Königgrätz, where the Prussians had little difficulty in beating the Austrians.

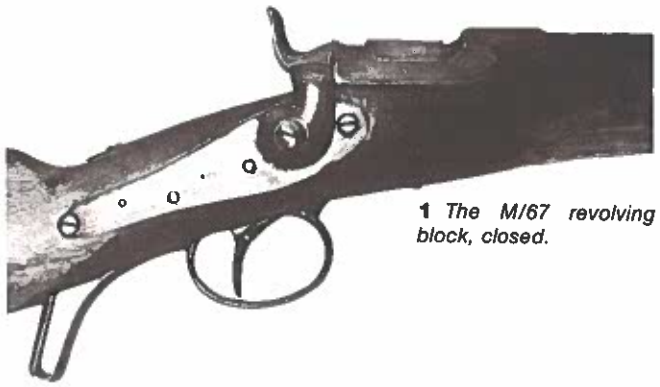
In the west the Prussians were firing their needle guns with a rapidity hitherto unknown in all military history. Bismarck's soldiers could re-load their rifles kneeling, or even flat on their stomachs. The Austrians, on the other hand, were forced to stand up and wield a long ramrod to re-load. The Prussians shot them down like "standing" ducks! General Benedeck foresaw the looming catastrophy for his Austrian forces in consequence of his country's outmoded firearms and, the night before Königgrätz, on July 2, 1866, despatched a message to his Emperor in Vienna.

"Our great losses are chiefly a result of the needle guns, the murderous firepower of which impressed everyone who took part in the battle."

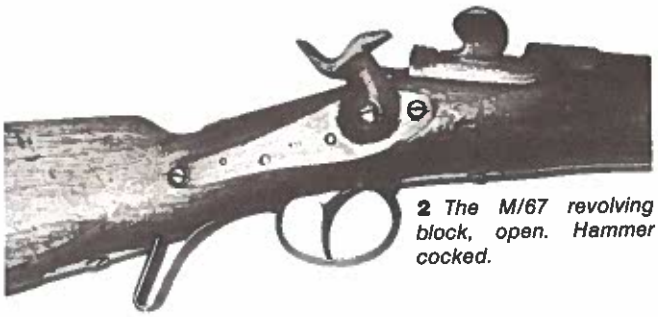
After Austria's defeat at Königgrätz all Austrian arms experts got together again to convene a new commission to speedily solve the armament problems of the k. u. k. Armee.

The new commission was confronted with two tasks:

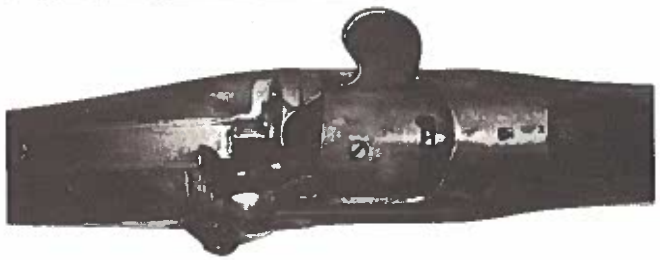
1. How best to convert the Lorenz rifle to breech loading metal cartridges.



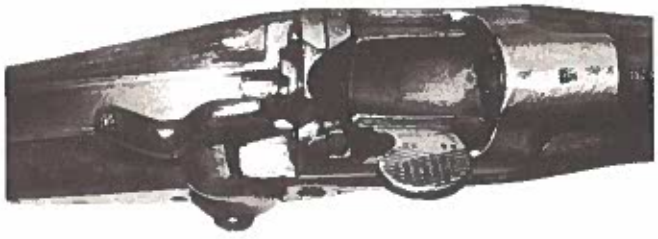
1 *The M/67 revolving block, closed.*



2 *The M/67 revolving block, open. Hammer cocked.*



3 *Block closed, showing extractor groove and firing-pin setscrew.*



4 *Top view showing loading channel. Note the characteristic angled outside hammer of the M/67.*

2. To choose the most suitable of the new breech loaders for Austria's military needs.

The first was merely a temporary solution, for there were very few conversion designs available that had been battle-tested and even the German needle locks had already been outmoded by the metallic cartridge. Furthermore there were not sufficient funds for a wholesale re-arming of the military forces and anyway the country's arsenales were still full of Lorenz muzzle loaders. For the time being, therefore, the commission accepted the suggestion put forward by the Viennese gunsmith Wänzel that the M/1854 muzzle loading rifle should be fitted with a simple lift-type block breech assembly to chamber a rim fire cartridge of cal. 13.5. Hence the Austrians made a difference between two M/67s, the one is the Wänzel conversion, the other the new design by Werndl. The second point required a snappy decision, as a number of the muzzle loaders in the arsenals were so worn that any conversion would be a waste of time and money. These rejects had to be replaced without further delay.

Of all the test rifles presented to the members of the commission, the Remington was the favorite. The modern gun-makers of America were offering for the first time a rolling block system that had been thoroughly proven during the Civil War. This system was also economical to manufacture. Remington's agents in Vienna aroused great interest with this new breech loader, and hardly a doubt existed that the Austrians would confer an order direct, or make the Remington under license in Austria.

But during the last phases of the commission's decision, Josef Werndl, a gun manufacturer from Steyr, offered a breech loading system of his own. He and his Czech assistant, Holub, had hastily developed a breech loader incorporating a lifting block that could be swung sideways out of the breech cavity. At the test range where the 21st Austrian fusiliers put all the contesting rifles through their paces, everyone was much surprised to discover that the Werndl was on a par with the Remington.

The groupings of these two rifles were perplexingly similar, the rate of fire of the Werndl though, so claimed the experts, was 20 per cent higher than that of the Remington. Since Josef Werndl was director general of the state arms factory, equipped with the latest American machine tools, one was naturally inclined to place such a large and important order with an Austrian concern, rather than with a manufacturer in a foreign country.

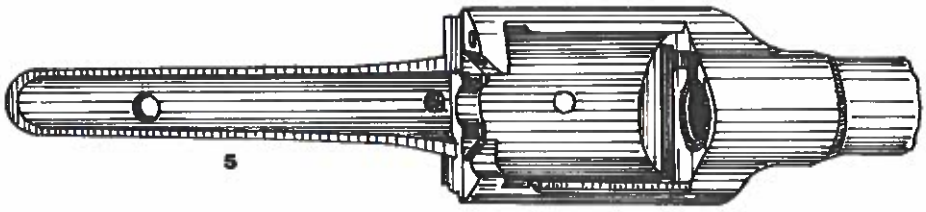
In July 1867 the Werndl was officially adopted as Austria's new rifle and 250,000 pieces were ordered from the Steyr factory. As Werndl had planned the production in great detail, it did not take long before 5000 rifles were being finished each week.

Werndl, who prior to the war of 1866, was convinced that it was only a matter of time before all armies would change over to breech loaders, was determined to found a gun factory in Europe along the lines of those giants he had seen in America during his apprenticeship years. And indeed, under the auspices of Werndl the Austrian gun factory at Steyr became one of the most efficient in Europe; at times he even produced more weapons than either Remington or Colt.

System Werndl

The main element of the M/1867 was its swing-over breechblock (Fig. 9) with jutting out thumbpiece. By depressing this thumbpiece the breechblock revolves around its own axis until a cut-out channel appears uppermost, allowing a metal cartridge to be slid into the now open chamber. When the breechblock is revolved back to its closed position the channel is no longer in line with the chamber, thus the cartridge is securely locked in place by the face of the breechblock. In the closed position, of course, the firing pin, housed in the breechblock, lies exactly behind the cartridge head.

In actual fact, the breechblock cylinder revolves back to its closed position under spring pressure, once the thumbpiece has been released. The spring (Fig. 10) lies in the tang (Fig. 5) of the receiver and is so powerful that the breechblock is locked in the home position, if the thumbpiece is not depressed. For the technically minded, I should point out that the end of this flat spring rests on the wedge that can

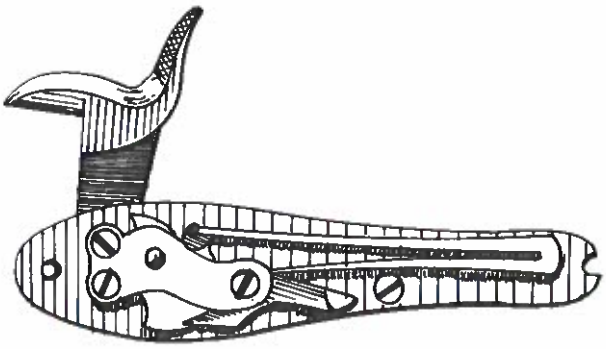


5

be seen at the rear side of the breechblock in Fig. 9. The outside hammer (Figs. 1–4) of the M/1867, a left-over from the percussion era, is angled strongly to the left to align with the firing pin and, as seen in Fig. 6, it has its own lockplate.

The firing pin (Fig. 7), owing to the asymmetry of the position of the cut-out channel of the breechblock when it revolves around its axis, is not in bore line but strikes at an angle.

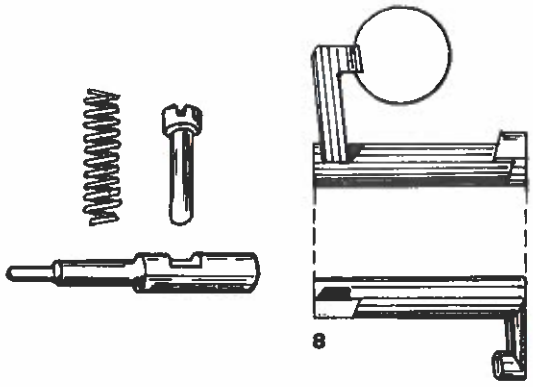
The extractor (Fig. 8), consisting of a shaft with two hooked arms, lies in a recess in the front wall of the receiver. The claw of one of the arms snaps in behind the slightly protruding rim of the 11 mm cartridge, the other runs in a groove in the breechblock and actuates ejection once it has reached a stop, viz. when the thumbpiece is fully depressed and the action is open.



6

I think it may be safely said that the Werndl-type revolving block is stronger than, and superior to, all other block systems past and present; for with the Werndl 8 to 10 well-placed shots per minute can be delivered with little difficulty.

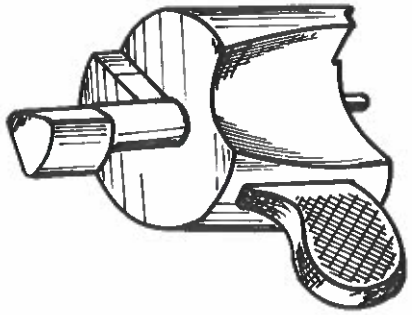
With the adoption of the M/67 the Austrians had managed to pass from muzzle to breech loaders relatively painlessly. The following two models were produced:



7 8

Infantry and Jaeger Rifle M/1867

overall length: 1280 mm, *weight:* 4500 g, *locked:* revolving block, *barrel length:* 843 mm, *rifling:* right-hand twist, 6 grooves, *sights:* blade front, elevating rear, graduated to 1050 m, *furniture:* two bands. two swivels, butt shoe, metal-frame pistol grip, later replaced with solid one, *calibre:* 11 mm. The receiver is acid gray, the barrel brown.



9

Carbine M/1867

There is no difference, mechanically speaking, between the infantry and carbine models, although the carbine is only 99 cm long, and weighs only 3200 g. It is chambered for the short 11 mm cartridge.

10

Cartridge for M/1867

The first centre fire cartridge of military calibre was also the smallest hitherto issued to the Austrian army. The bullet was ogival in shape, of soft lead, double cannelured, and slightly hollow-point. To counteract brittleness, pure copper was not used henceforth in the manufacture of cartridge cases (cf. Wänzel cartridges); Tombac, an alloy of copper with a little zinc, was found to be a great improvement. However, the collector must draw a line here between the normal 11 mm cartridge (60.4 mm long) for the M/1867 rifle and the short 11 mm cartridge (46 mm long) for the carbine. It is also interesting to note that there existed a pipsqueak load for range practice.

Werndl breechblock M/1873

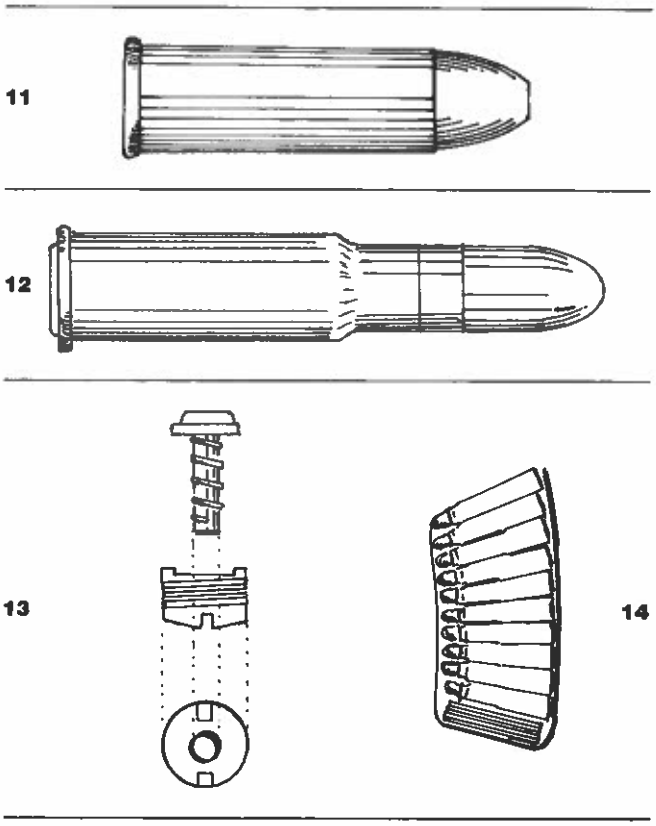
Improvements to the revolving block system had already been cogitated upon by 1873. The outside hammer had been whisked out of sight into the action and the flat spring (Fig. 10) that locked the breeckblock was replaced by a recoil spring and plunger (Fig. 13), whereby the long tang that housed the flat spring was discarded.

The new cartridge M/1877

In 1877, rapid developements in weaponeering led to the introduction of a new cartridge that had already been war-tested by other states, viz. in the Franco-German and Turko-Russian campaigns.

The calibre of 11 mm was retained, but muzzle velocity and range were substantially increased by using a stronger powder. Instead of tombac, which had replaced pure copper for making cartridges cases, brass began to find favour. The new rifle cartridge (Fig. 12) is 74 mm long, bottle-necked, and has both a protruding rim and protruding primer. The short 11 mm cartridge for the carbine was reduced to 53 mm in length.

The hollowed bullet is paper patched and lubed at the projecting end. The prop is of wax, and is sandwiched by two strips of carboard.



5 *The receiver of the M/67 showing cavity in which the breechblock revolves. The flat spring Fig. 10 lies in the tang to keep the breechblock in closed position. Under the chamber one can see the recess for the cartridge extractor, Fig. 8.*

6 *Lockplate and hammer.*

7 *Firing pin, spring and setscrew.*

8 *Hooked-arm extractor.*

9 *The heart of the M/67, revolving breechblock with thumbpiece. Note loading channel, and rear ledge for flat spring, Fig. 10.*

10 *Flat spring for tensioning breechblock.*

11 *Metallic cartridge for M/1867 carbine.*

12 *Metallic cartridge for M/1877 rifle.*

13 *Spring plunger that replaced flat spring, Fig. 10, in 1873 model.*

14 *The Krnka box-type magazine.*

After slight changes (sights, enlarged loading space) the M/67 rifle and carbine were re-named the M/1867/77.

Werndl bayonet

The so-called sabre bayonet, illustrated in Fig. 16, was the first Austrian bayonet with a hilt to succeed the socket-type bayonet that had seen service on earlier rifles. The M 67 sabre bayonet is hollow ground on both sides, is slightly curved and weighs 0.7 kg. By means of the quillon and spring lock, the M 67 can be securely attached to the right of the rifle's foresight block. The covering for the serrated hilt was partly made of soling leather and partly made of hard rubber. The M 73 sabre bayonet is a little shorter than the M 67, and weighs just 0.5 kg.

Werndl sporting rifle

Soon after the adoption of the M/1867 by the military, the Werndl was re-stocked for the hunter. This rifle was being industrially produced in such masses that private people could now buy a breech loader at a reasonable price for the first time. Of especial interest to the historian were the Werndl rifles used by Payer and Weyprecht in 1872 during their famous North Pole Expedition. Since normal steel used in gun manufacture becomes brittle under the extremely low temperatures found at the poles, bronze was used (Heeresmuseum, Vienna).

15

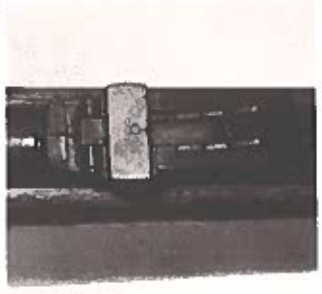
16

15 *Muzzle of the M/67 with bayonet support rod.*

16. *The M/67 sabre bayonet.*

17, 18, 19 *Elevated rear sight.*

17



18

19

20

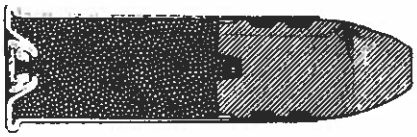
20, 21 *View along top barrel showing revolving block in open and closed position.*

22 *Phantom view of M/67 cartridge.*

23 *The Werndl pistol of 1867, adopted by the Austrian army, soon ousted by the introduction of the revolver.*

21

22



23

Werndl pistol

It was decided to adopt these pistols for the Austrian cavalry regiments, although the Lorenz pistol was already in use. The Werndl was adopted in 1867, but had not reached mass production when the Austrian-Hungarian army became equipped with the Gasser M/1870 revolver.

Rapid loaders

In 1874 an attempt was made to raise the rate of fire by converting the existing rifles to the Czech Krnka system. Krnka had already designed a series of quick-loading actions by 1874, whereby loading, ejecting and cocking could be carried out with one hand by manipulating a side lever. However, the experts considered the change-over much too expensive and thought it would be wiser to invest in the new repeating rifles. In 1883 Krnka's son designed a sheet-steel box type magazine (Fig. 14), which had similarities to the ones we know today. The Krnka magazine is hooked to the left side of the action housing, it contains 10 cartridges fed under spring pressure, though each cartridge was taken out seperately and loaded into the rifle's chamber by hand.

Both these inventions helped to make loading simpler and quicker, but, as they were still viewed as makeshifts further improvements were not attempted. Unlike the Mauer, the Werndl rifles were absolutely unsuitable for conversion to a quick - loading action. In 1886 the Austrian army replaced its Werndls with Mannlicher repeaters.

Edged wea

Gerhard Seifert

Of all the staff weapons the halberd is doubtless the best known. This may be ascribed to its unusual shape and to its great importance in earlier centuries. The halberd is an axe-like weapon with a hook on the back and a spike on the head. Its name is derived from Middle High German, meaning: halm or helm = handle, barta or barte = axe. In consequence of their original shape, the halberds were chiefly used for cutting and slashing. In time, however, they developed into "cut and thrust" arms. Still, at the end of their military usefulness, the halberds underwent further changes, and at times could only be regarded as thrusters. Eventually they denoted the rank of certain non-commissioned officers; were issued to the night-watch, to wagon drivers, etc., and hence disappeared completely from the noble list of combat weapons. The first arm to coun-

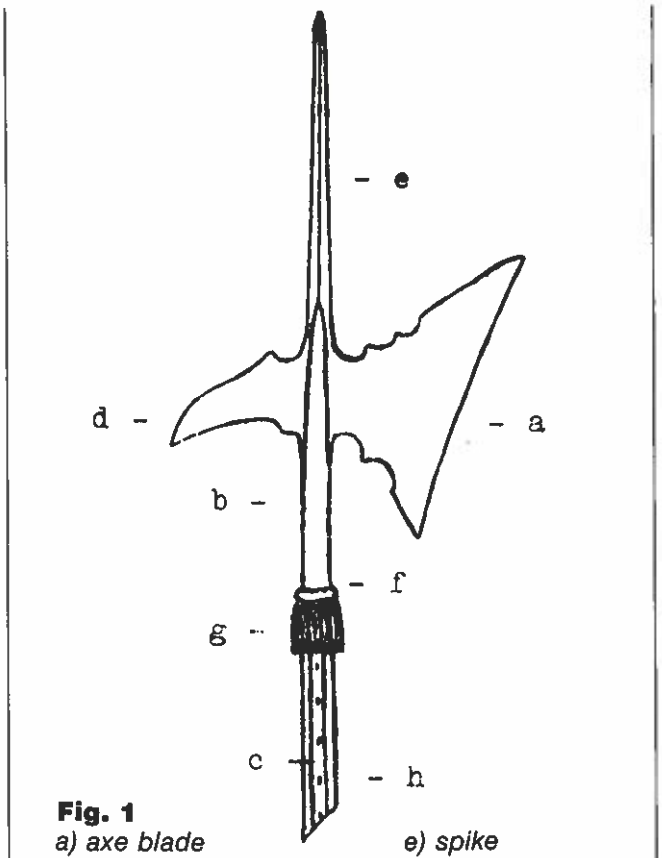


Fig. 1
a) axe blade
b) socket
c) tang
d) hook
e) spike
f) ring
g) fringe
h) shaft

pons The Halberds

tervail the halberd was the long spear. Weapons shorter and easier to wield, however, apart from the ever-increasing number of firearms, displaced the halberds for all time. The oldest specimens that can be seen today stem from the end of the 13th/ beginning of the 14th century and come from Switzerland. Indisputably, the halberd was the "new arm" of the citizens of the original Swiss cantons of Lucerne, Schwyz, Unterwalden and Uri, who were forced to protect themselves desperately against Hapsburg knights on horseback. With the help of the halberd the Schwyzer and Urner defeated the army of Leopold I at Mt. Morgarten, in 1315. And in later battles, too, the halberd carried the Swiss on to victory: at Laupen (1339), at Sempach (1386), at Näfles (1388) and finally at Merten (1476) and Nancy (1477). Karl the Daring, of Burgundy, was compelled to retreat. However, Sempach proved for the first time that the halberd also had its limitations. The knights driven into difficult terrain, were obliged to dismount and ward off the Swiss attackers with their long spears. Since the spears were longer than the halberds the Hapsburgs won the day after all. Eventually, though, as history tells us, the Swiss repelled all enemies from their lands. But let us return to the origins of the halberd. Actually, there are a number of versions in circulation. According to the opinion of the author of this article, Dr. W. Schneewind's version is the most likely. This edged-weapons expert believes that the halberd can be traced back to the Danish two-handed battle-axe. Via England, this arm then appeared in France (hache danoise). In 1289 Swiss mercenaries used it at Besancon when serving the Hapsburgs. Lengthening the pole to nearly 6 ft. or more

Fig. 2 *Approx. the basic shape of the halberd*

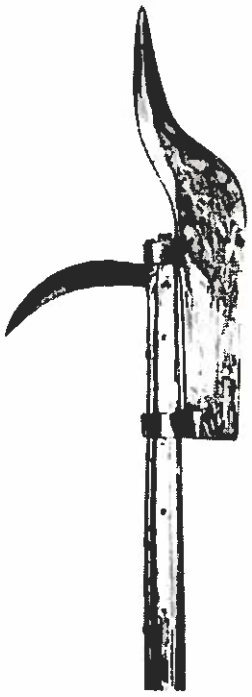


Fig. 3 *14th century, second half.*

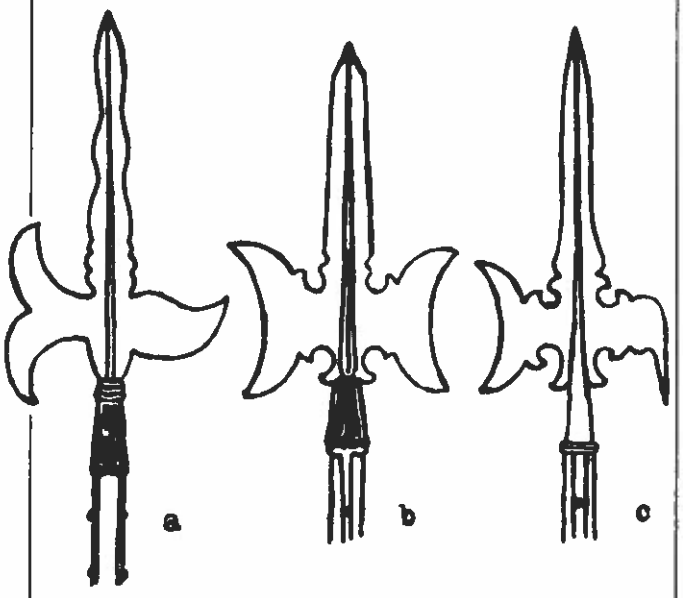


Fig. 4 *The halberd as a military badge of rank (here: Austria)*
a) Sergeant 1705
b) Wagon driver 1705
c) Corporal 1705 *(after Dolleczek)*

may be considered a Swiss innovation, whereby the shape of the axe was often simplified or changed. The long pole could be swung with such force that the axe head penetrated both breast-plate and helmet.

Before we continue I should perhaps say something about halberd nomenclature, as these words are not in everyday use.

The two main components are the axe head and the pole or shaft. The axe head consists of a) the axe blade, b) the socket, d) the hook, and e) the spike.

The pole itself, usually ash, consists of f) the fastening ring, g) the fringe and c) the tangs. The fastening ring gives extra support, for the tangs are only nailed on to the shaft. It is believed that the fastening ring first appeared at the beginning of the 16th century. Until approx. the 17th century the shafts were unshod. Again, the fringe did not put in an appearance before the middle of the 16th century; during later periods it grew tremendously in size. However, it will perhaps be wiser if I describe the parts alphabetically in more detail.

a) The axe blade: Used as a combat weapon, the blade was reinforced with a steel cutting edge, the two metals being welded together. On old models this edge is extraordinarily sharp. The basic shape of the blade bears a resemblance to an asymmetrical trapezium (Fig. 2). This shape was retained till the end of the 14th century, except for the thruster variants. In the next century the axe blade became nearly rectangular. Towards the end of the 14th century the cutting edge began to appear with a convex curvature; and during the first half of the 16th century the cutting edge slanted towards the shaft.

Towards the end of the 16th century the spike was the dominant feature, the cutting edge of the blade very gradually assuming a concave curvature. This blade was often left blunt, since the weapon was now useless for slashing.

b) The socket: This is for holding the shaft. As seen in Fig. 2 the blade was originally fastened to the shaft with two welded bands.

These bands can be compared to the eye of an axe and they remained on the scene till the end of the 14th century. After the introduction of the hook, the bands gave way to the one-piece socket, approximately at the beginning of the 15th century.

c) The tangs: The sockets of some of the 14th century halberds have extensions or tangs running

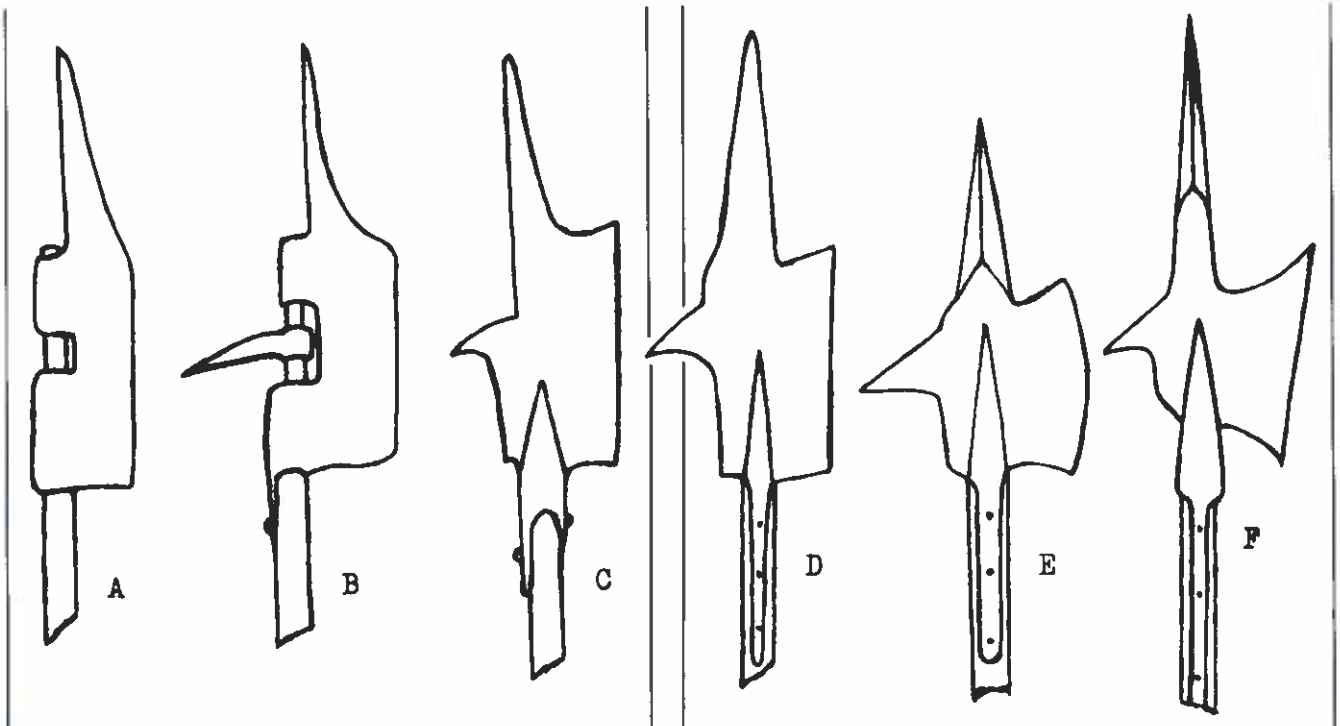
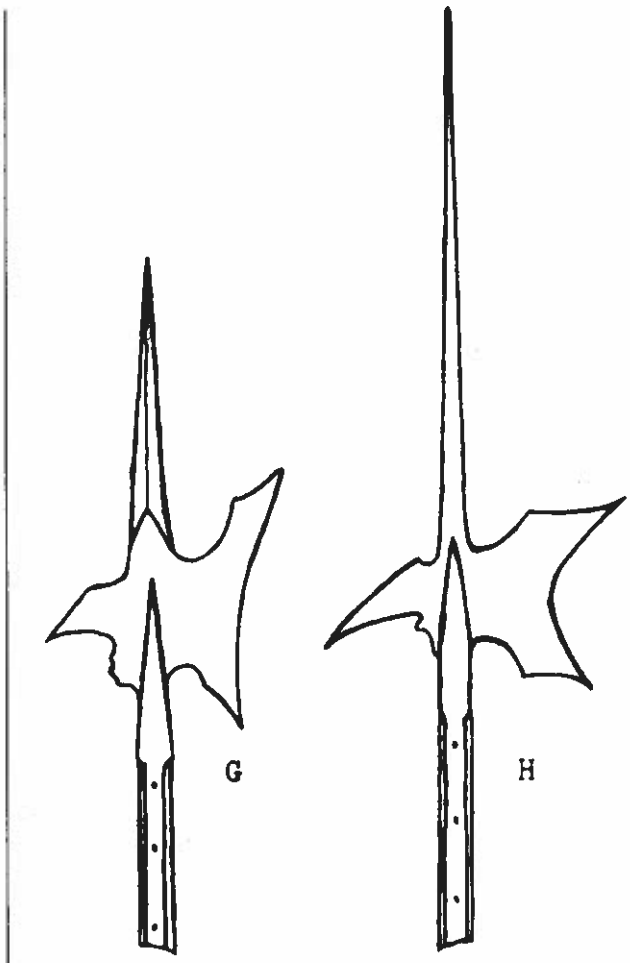
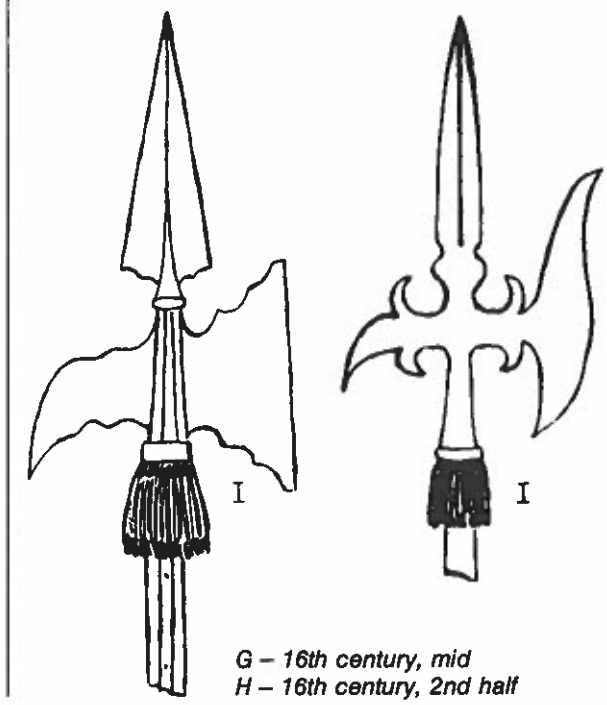


Fig. 5
Basic shapes

A – 14th century, 1st half
B – 14th century, 2nd half
C – 15th century, 1st half
D – 15th century, 2nd half
E – 15th century, end of 16th century, beginning of
F – 16th century, 1st half



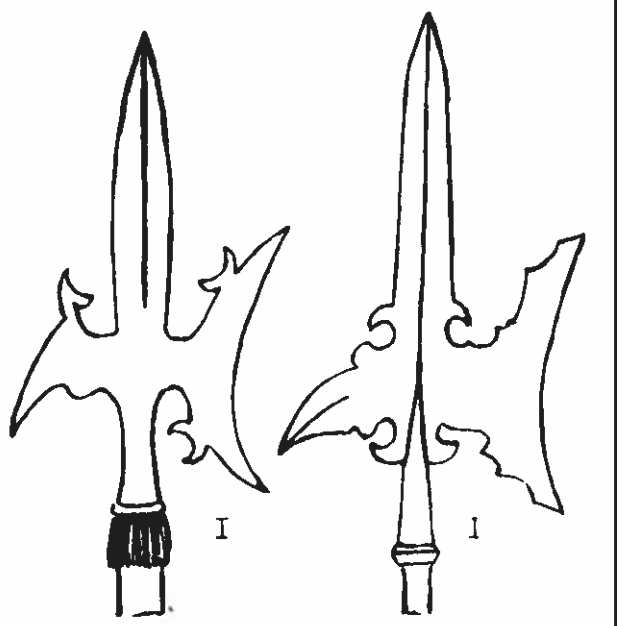


G – 16th century, mid
H – 16th century, 2nd half

down the rear side of the shaft, which in time became longer. A little later these tangs could be seen running down the front side of the shaft, too. Indeed, in some specimens the tangs ran down the sides. It is probable that this was to help prevent the head of the halberd from being chopped off by the enemies' swords. Again, some halberds have tangs on three or even four sides of the shaft. In such cases the back and front tangs are under the fastening ring.

d) The hook: Until the middle of the 14th century the halberds did not display a hook. Prior to the beginning of the 15th century the hook was not an integral part. As seen in Figs. 3 and 5 (B) the hook was attached to the shaft, at times forged out of the top of the socket. However, when the full-length sockets became general practice, axe blades and hooks were forged in one piece. By the 16th century this hook had grown to majestic proportions, and was used for slashing and grappling with the arms of the enemy. Still, its importance was overshadowed by the spike and it began to dwindle in size during later periods.

e) The spike: It must ramain unclear whether the upper part of the axe blade was originally designed for thrusting.



I – 17th century

Fig. 6

Fig. 6 *From left to right Basic shapes E, A/B, F and H*

Fig. 7 *From left to right Basic shapes F, E, C/D, D and F*

Fig. 8 *From left to right: Basic shapes F/G, G, E, F and F/G*

Fig. 7

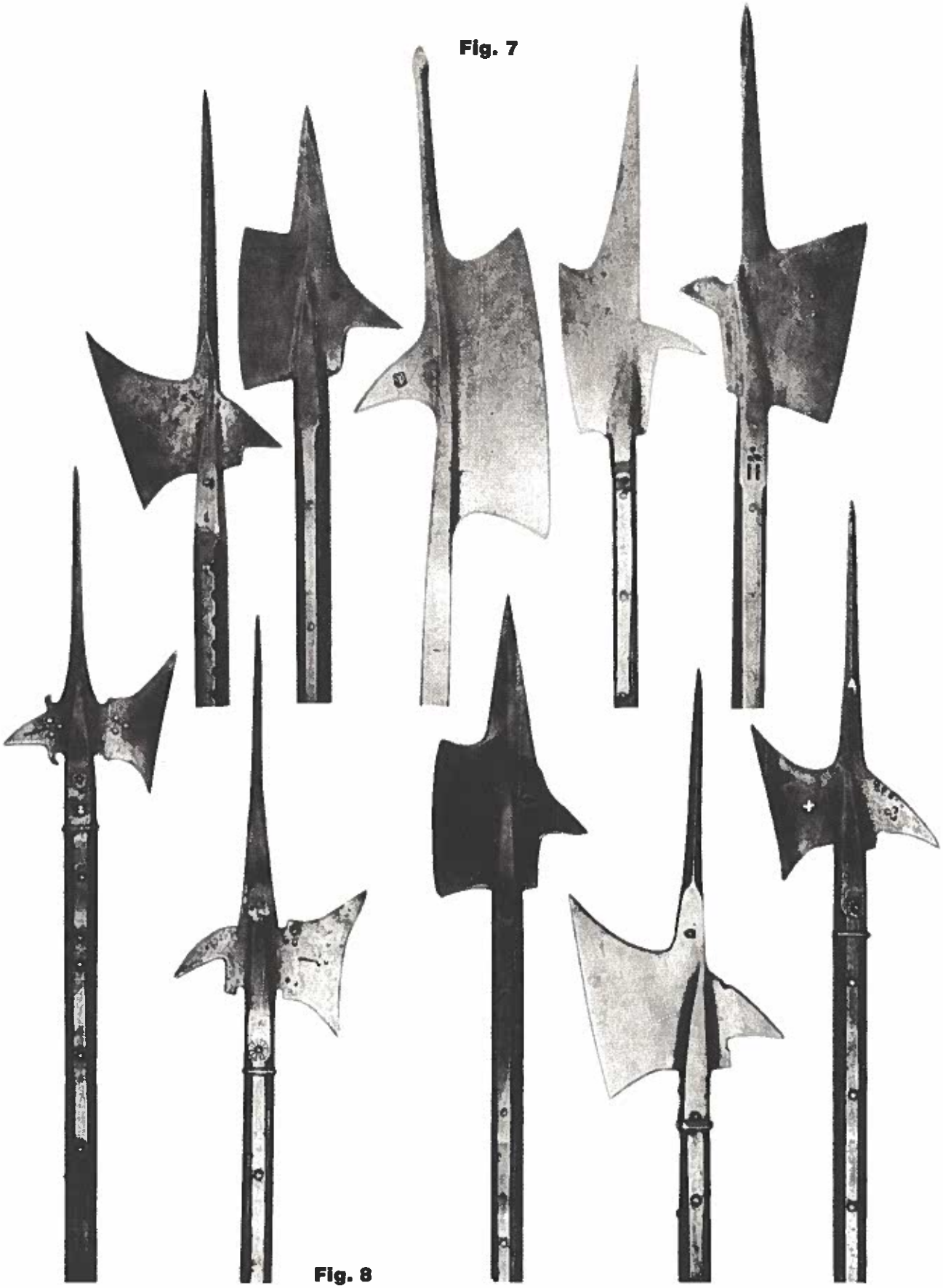


Fig. 8

At any rate, the spike soon became an extra part of the halberd blade (cf. Figs. 1 and 2), but seldom longer than the blade itself. The spike was always in line with the shaft, and was usually shaped as a long asymmetrical triangle, although backward sweeping spikes or spiked blades (Fig. 3) were also made. Towards the end of the 15th century the spike became more triangular, and was a true rectilinear extension of the shaft. Since the end of the 15th century, though, the spike became narrower, a shape retained until the beginning of the 16th century. However, at about the time when the cutting edge of the axe blades began to slant towards the shaft, the spike suddenly shot up in length. It could be compared to a rapier, but was usually four sided. Fig. 9 depicts a number of these long-spiked halberds; the longest spike of which measures 86 cm. The highly decorated ones carried by the soldiers of the bodyguard are today very valuable. Many of them bear the coat-of-arms or monogram of secular and ecclesiastical potentates and occasionally, dates. The halberds survived during the 18th century as military badges of rank (Fig. 4). In Fig. 5 an attempt has been made to classify the basic shapes in their respective centuries.

Of course, there are no absolute norms of classification for every single type of halberd, since their design was in a permanent state of flux. Figs. 6 to 10 depict, by courtesy of Auction House Galerie Fischer KG, Lucerne, the basic shapes as sketched in Fig. 5.

So-called cross-breeds, chiefly products of the 17th and 18th centuries, cannot be dealt with within the limited scope of this introductory article.

Fig. 9 *I-type halberds.*

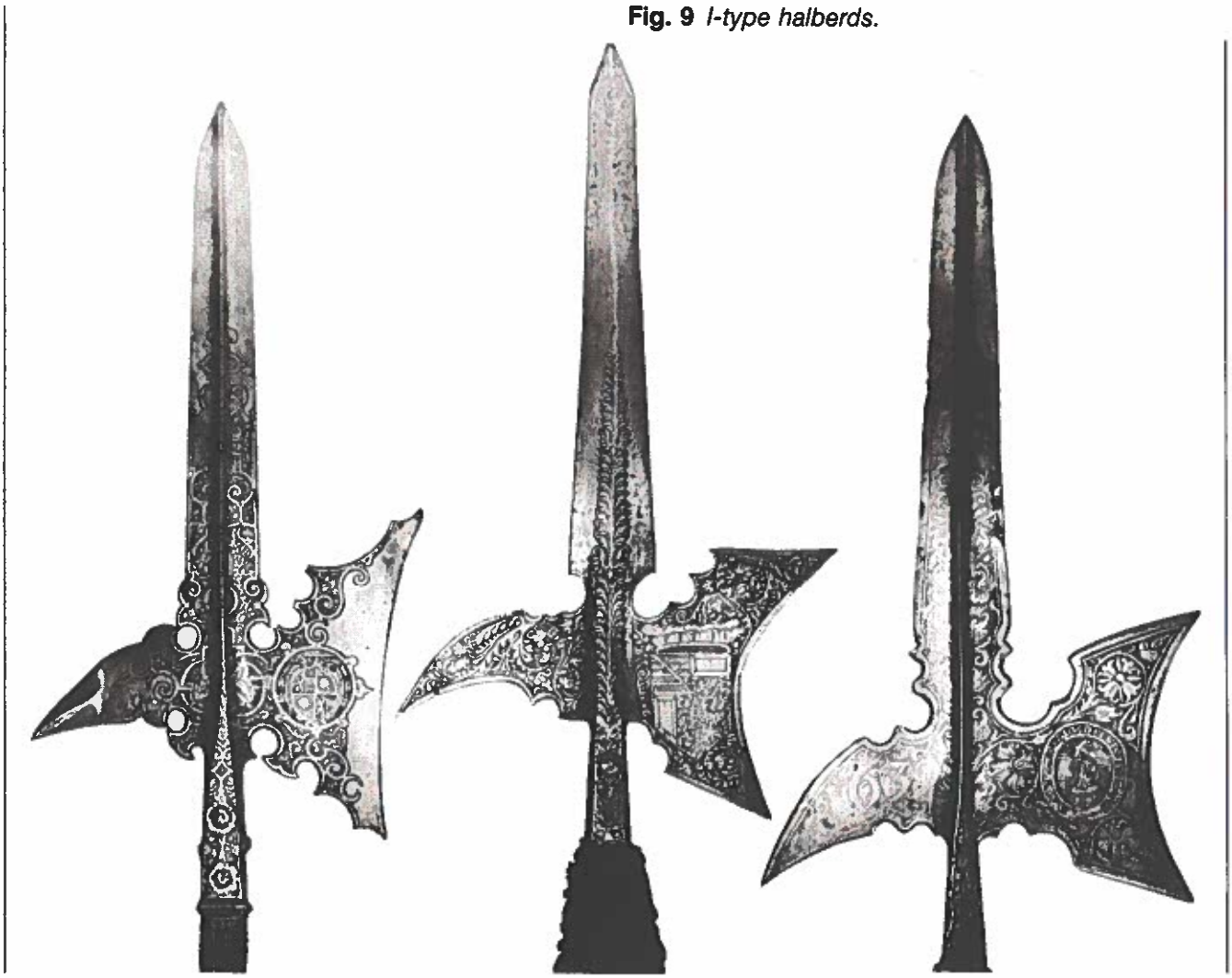


Fig. 10 *Six H-type halberds*
(Note the glaive in the centre)

THE HEEREN-

Text und photos:
Günter Freres

In the second half of the nineteenth century those countries that had an arms industry feverishly began producing new single-shot breechloaders. The lock systems varied tremendously, but two main types crystallized after a period of experimentation, the pivoting block and the falling block. The first-mentioned type, made famous by Peabody, Martini and Werder, consisted in pivoting the breechblock at the rear end as high as or higher than the barrel; to load, the front end was pulled down by a mechanical device to allow a cartridge to be inserted into the chamber. The dropping or falling block system had a very solid breechblock that slid vertically up and down in mortises in the receiver walls.

In 1880 Colonel Heeren, who lived in Baden-Baden, was granted a patent for the dropping block system. In Tierbach's "Handfeuerwaffen" that was published in 1886/87 I found a description and illustration of the Heerenbuchse, which you will find reproduced at the end of this article. When comparing the original breechblock system with that of the modern copies of the Heerenbuchse, one is astonished to see that very little has changed. Colonel Heeren's construction was so ingenious that nearly 90 years later his design has remained as it was, or nearly so. I am sure this design will survive to celebrate its hundredth anniversary.

The first firm to produce the Heerenbuchse was Hagel & Menz of Baden-Baden. However, it is not known how many of these rifles were made nor how long the production was kept up. The firm of Glaser in Zurich (Switzerland) manufactured a number after the war, but did not continue with them for very long. The Austrian firm of Orechowsky, Graz, also produced the Heerenbuchse under the name of OREA for a short period. The Heerenbuchse then disappeared from the market until the firm of Furtschegger, in Kufstein/Austria, took up production. It is now known that Waffen-Frankonia of Wurzburg/Germany was responsible for their re-introduction.

At this point it might be interesting to take a look at the technical side of sporting arms. There was a time in Germany when the single-shot moving breechblock system was used on all sorts of commercial longarms. This period ended in 1945. Since then they really have only the Weihrauch and the Heeren breechblock systems. In America, where the first movable breechblock rifle made its appearance in 1862, there has been a revival of this type of lock and in the last few years two versions have been particularly successful. Perhaps its comeback in the USA will increase its popularity with European gun fanciers and sportsmen.

The Heeren design, Baden-Baden, patented in the year 1880, shows another breech system with dropping block. This model distinguishes itself through its simplicity and small number of parts. The lock and hammer are accommodated on the trigger assembly, whereby the trigger guard is pulled in a downward direction to actuate the breechblock.

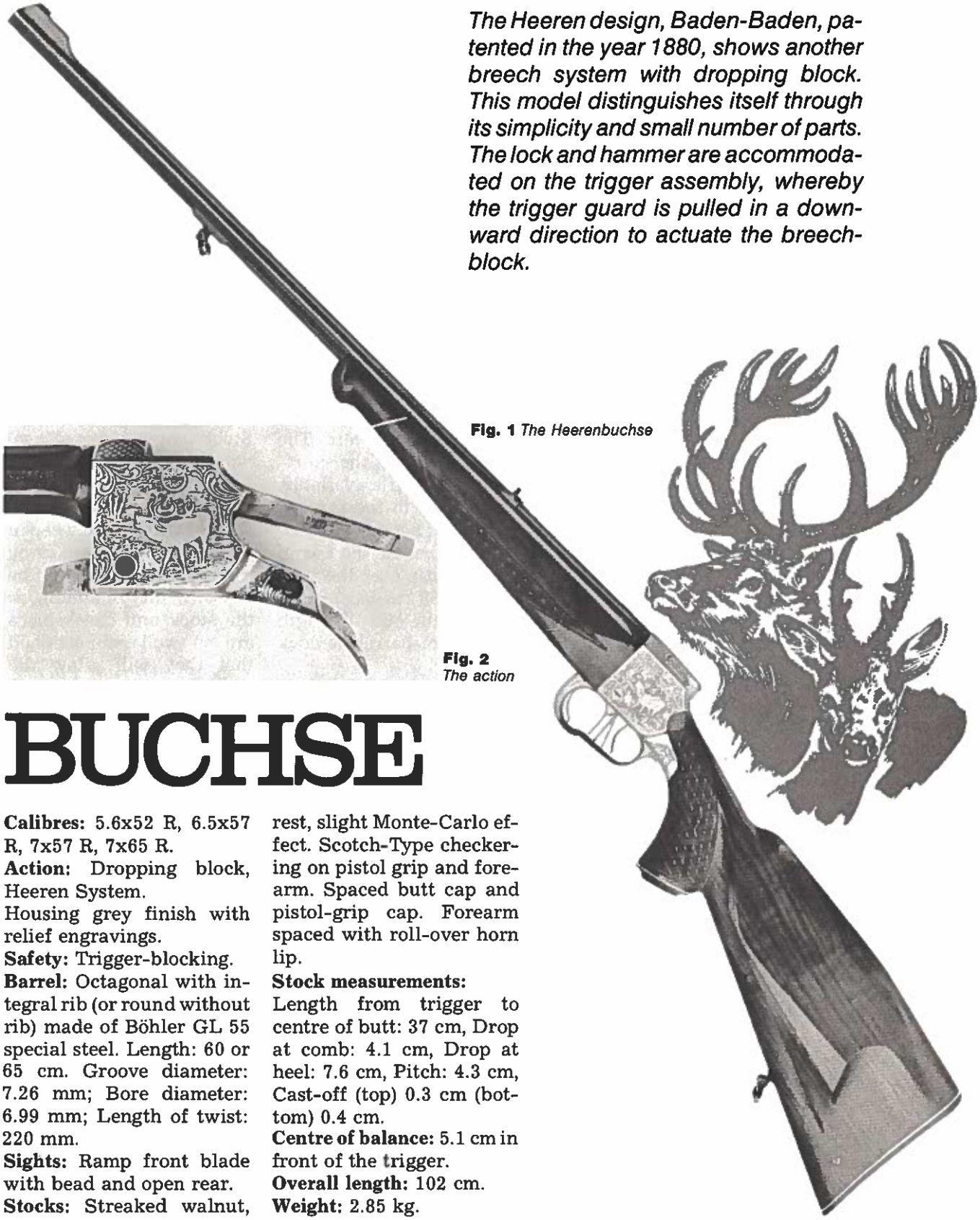
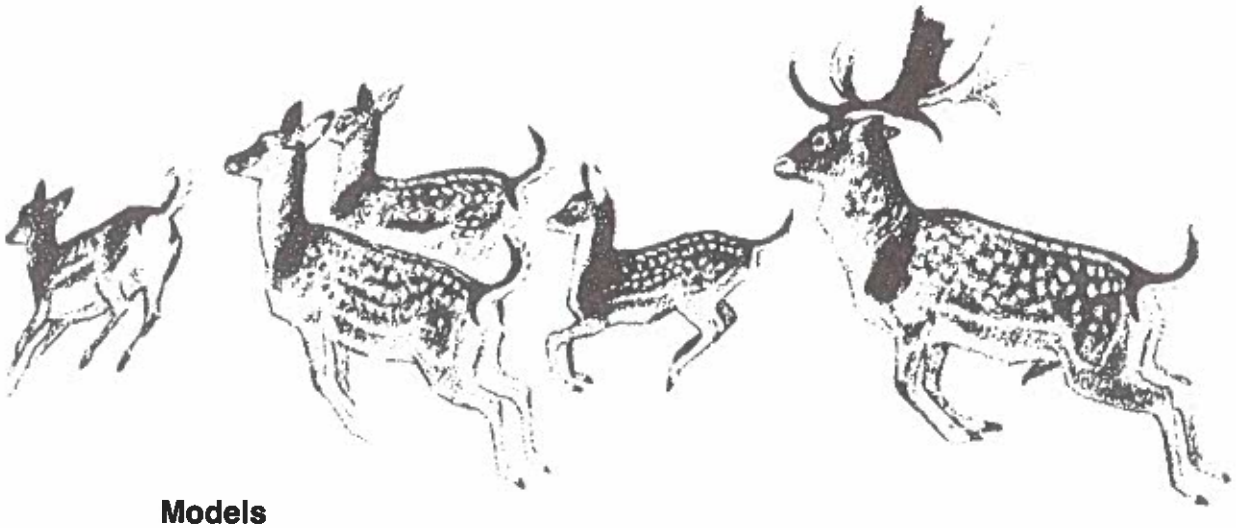


Fig. 1 *The Heerenbuchse*

Fig. 2
The action

BUCHSE

Calibres: 5.6x52 R, 6.5x57 R, 7x57 R, 7x65 R.
Action: Dropping block, Heeren System.
Housing grey finish with relief engravings.
Safety: Trigger-blocking.
Barrel: Octagonal with integral rib (or round without rib) made of Böhler GL 55 special steel. Length: 60 or 65 cm. Groove diameter: 7.26 mm; Bore diameter: 6.99 mm; Length of twist: 220 mm.
Sights: Ramp front blade with bead and open rear.
Stocks: Streaked walnut, pistol grip, Bavarian cheek rest, slight Monte-Carlo effect. Scotch-Type checkering on pistol grip and forearm. Spaced butt cap and pistol-grip cap. Forearm spaced with roll-over horn lip.
Stock measurements: Length from trigger to centre of butt: 37 cm, Drop at comb: 4.1 cm, Drop at heel: 7.6 cm, Pitch: 4.3 cm, Cast-off (top) 0.3 cm (bottom) 0.4 cm.
Centre of balance: 5.1 cm in front of the trigger.
Overall length: 102 cm.
Weight: 2.85 kg.



Models

The Heerenbuchse is available in two different stocks, with round barrel or octagonal barrel with rib, 60 or 65 cm in length. For this report I chose a Heerenbuchse in calibre 7x65 R with two-piece stock and 65 cm octagonal barrel (Fig. 1). It is a beautifully balanced and elegant-looking rifle, its grey stained action with fine deep-relief engravings being particularly tasteful. The octagonal barrel with intregral rib does more for the Heerenbuche's appearance than does the round barrel. The extra fine, streaked walnut stock with Bavarian cheek and roll-over forearm are additional features for both hand and eye. All in all, this rifle has a very solid and conservative air about it. Perhaps that is why it appeals to deer stalkers who want to own something very out of the ordinary.

The Heerenbuchse handles favorably. The one I am describing weighs 2.85 kg, its overall length measures 102 cm (barrel 65 cm) and it balances at only 5.1 cm in front of the trigger. For stalking, its weight is just about ideal, even for trips in the mountains; yet with the heavier cartridges the recoil is not too severe. The Heerenbuchse is the shortest sporting rifle available. This is due to the squareness of the action, whereby the chamber of the barrel rests exactly over the trigger. The 68 cm-barrel version has the overall length of a 60 cm-barrel boxlock drilling.

The forearm is chunky in stature and together with the roll-over lip this feature gives the left hand something to grip. However, I find the pistol grip a little disturbing. Its shape corresponds more with the Austrian school of thought, straight at the top and long and bulbous at the bottom. Personally, I find the ball of the thumb comes to rest prematurely. In order to get a better grip, the hand tends to work its way forward until the middle finger lies behind the trigger guard. In this position your middle finger is in for some very painful bruising, I can tell you! The appearance of the Heerenbuchse would not be spoiled if slight changes were made to the pistol grip. The rifle positions superbly when shouldered. Stock length, drop at heel and pitch are so good that the sights are virtually lined up automatically when raising the weapon for firing. Even when using a scope there should not be any difficulty in aiming, as the stock and cheek-piece are so well proportioned that they will allow the cheek to lie higher.

Mode of operation

The cast steel action contains only 4 main parts: the trigger assembly (Figs. 5, 6, 7), the breechblock (Fig. 11), the extractor (Fig. 11) and the safety unit (Fig. 10). The frame of the trigger assembly has a 45° protrusion that engages in the breechblock (Fig. 8). This frame also contains the release catch, the hammer and hair trigger, the hammer spring and the tie bar (Fig. 10). An additional spring (not seen) serves the release catch and trigger. The frame of the trigger assembly is hinged just before the pistol grip. The

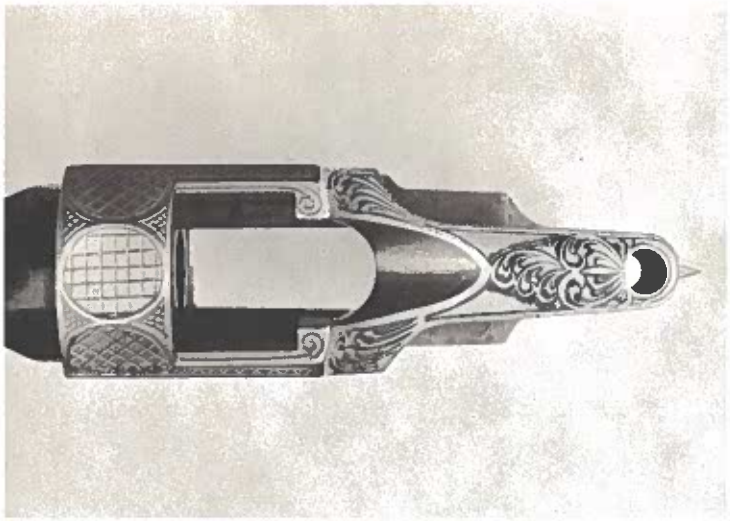


Fig. 3 *The action, top view*

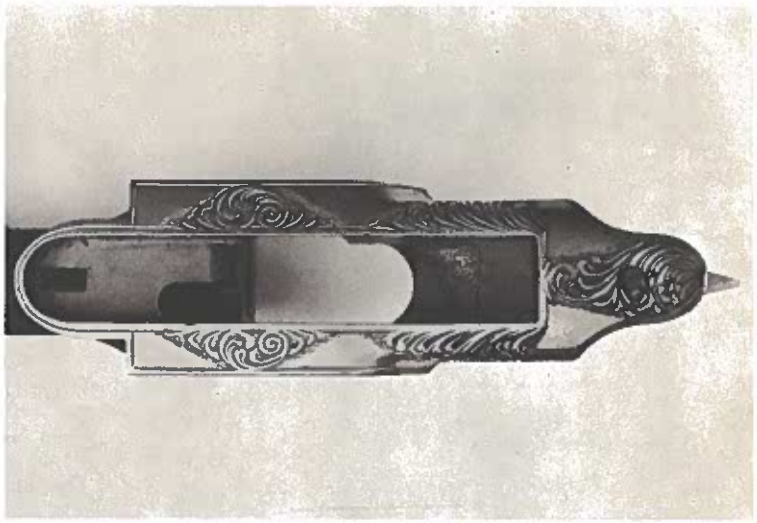


Fig. 4 *The action, bottom view*

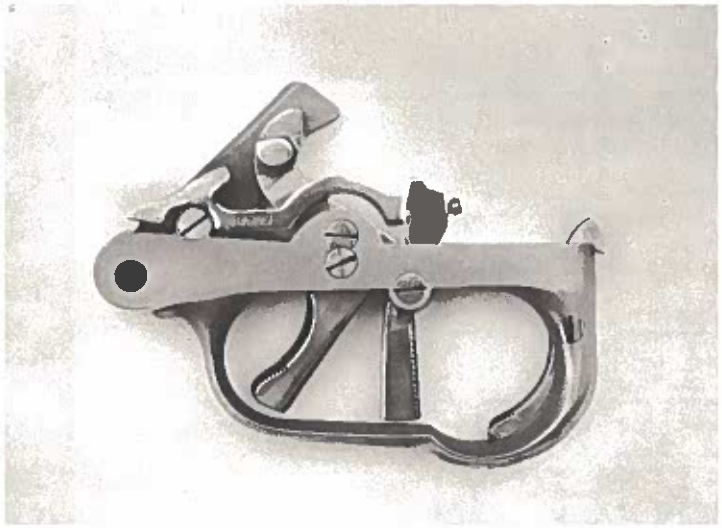


Fig. 5 *Trigger assembly, hammer uncocked*

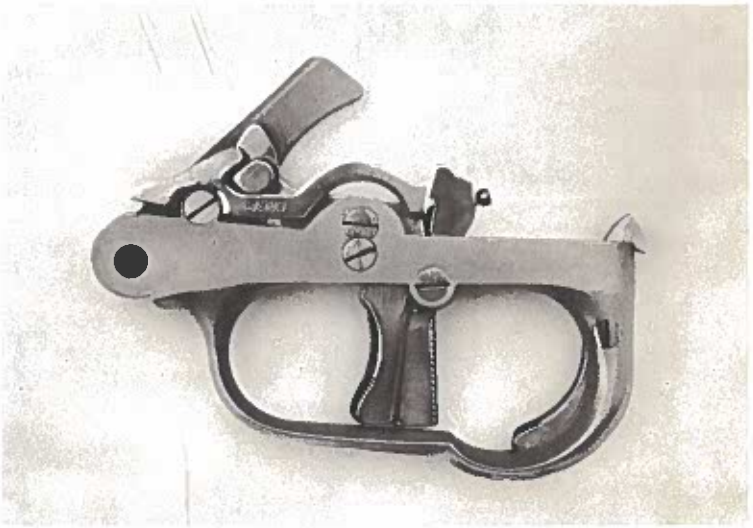


Fig. 6 *Trigger assembly, hammer cocked*

Fig. 7 *Trigger assembly, hair trigger set*

Fig. 8 *Breechblock and trigger assembly, firing position*

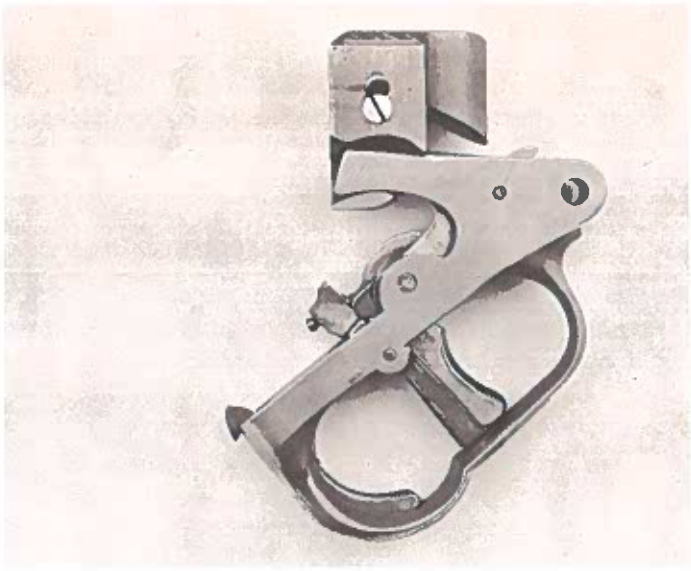


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Fig. 9 *Opening position*

Fig. 10 *Top row (left): tie bar, screw and spring; hammer spring; Hammer and hair trigger; main trigger; safety catch with spring and ball bearing (not part of trigger assembly); bottom row (left): hinge pin and grub screw; frame; release catch, spring and screw.*

Fig. 11 *The breechblock, left: extractor and screw pin (not part of block); locking lug assembly; firing pin and retainer.*

Fig. 12 *Trigger assembly in down position to open breech.*

THE HEEREN-BUCHSE

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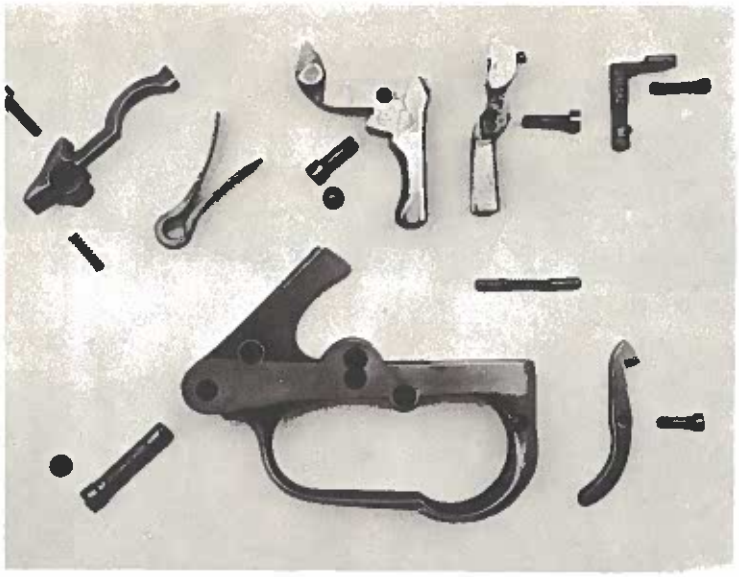

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breechblock contains a spring-loaded locking lug and also the spring-loaded firing-pin. The extractor is mounted on the left of the housing and the safety catch, on the right-hand side, blocks the trigger (Fig. 15).

To open the breech, depress the release catch and pull firmly down on the trigger guard. The 45° protrusion of the trigger assembly brings down the breechblock (Figs. 8/9) which, in turn, cocks the hammer by forcing it down to engage in the crook of the tie bar. The breechblock has now reached its lowest position and a cartridge can easily be placed in the chamber (Figs. 12/13/14).

To close the breech simply push the trigger assembly back up till it clicks. The locking lug in the breechblock engages in a recess in the wall of the housing. By actuating the straight, most unconventionally formed trigger, the hammer is released from its detent and flies up under spring pressure, striking the rear of the firing-pin in the breechblock. The Heerenbuchse is equipped with a hair trigger, too. This is also unconventional from the mechanical point of view. The lower, visible part of the hammer is trigger shaped and it is this which is pushed forward to set the hair trigger. The hammer spring is tensioned slightly more, taking pressure off the main trigger. The amount of pull can be adjusted via a screw that regulates leeway between trigger and tie bar.

The firing-pin travels obliquely in the breechblock, striking the seat of the cartridge from a lower to higher angle. This fits in with the design of the gun and cannot very well be changed. The extractor, shaped like a bellcrank lever, is steered by the breechblock. When the breech is opened the cartridge or hull is thrown clear. The safety catch blocks the trigger movement only.

One cannot but be impressed by the beautiful simplicity of this single-shot breechloader. Each mechanical movement causes a counter-movement. By pulling down the trigger guard the breechblock is simultaneously lowered. This in turn cocks the hammer and actuates the extractor. Again, it is not only possible, but also simple, to un-cock the Heerenbuchse. Place your thumb behind the hair trigger and release the main trigger. Now slowly let the hair trigger fall back under spring pressure. As the hair trigger and hammer are of one piece, the weapon is now un-cocked. On the other hand, the weapon can be easily cocked in the reverse manner. In other words, the "Hammerless" Heerenbuchse can be cocked and un-cocked without opening the breech.

The supporting areas of the block measure about 200 sq. mm, whereas the supporting areas of normal

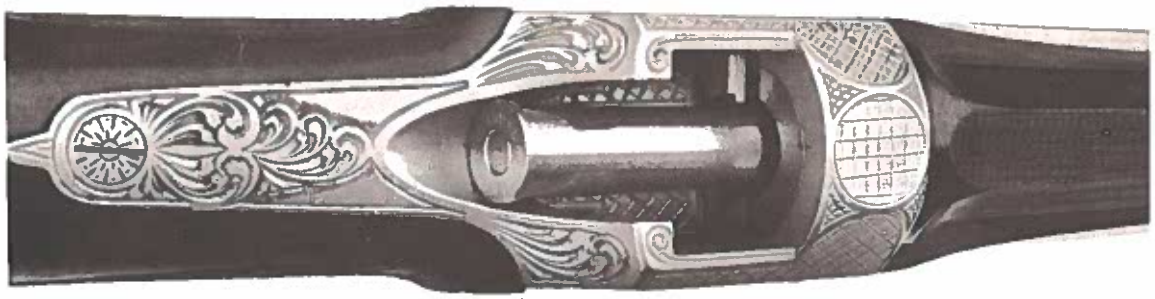

Fig. 13 *Cartridge being inserted into the open breech.*

Fig. 14 *Breechblock in closed position.*

Fig. 15 *Ready to fire (hammer cocked).*

THE HEEREN-BUCHSE

bolt-lock systems do not measure more than 100 sq. mm. If one works out the pressure that bears down on each sq. mm when the shot is fired it will be seen that the Heerenbuchse is well fortified with under 20 kp/sq. mm. This proves that, with regard to material stress, this breechblock system brings with it decided advantages, an attribute that also improves one's shooting.

The occasional jamming of the action after a shot is fired, the chief malfunction of movable breechblock loaders, no longer holds true with the Heerenbuchse. Despite the relatively powerful 7x65 R cartridge, I did not experience a single stoppage. I will even go so far as to say that I did not detect an appreciable difference between opening the breech after firing a cartridge and opening the breech on an empty chamber! In fact the breechblock fits so perfectly into the receiver that I could not pass a feeler gauge between the two at the chamber end.

Performance

The Heerenbuchse reviewed for this report came without a scope. As shooting with iron sights has its problems, I decided to put this rifle through its paces at 50 m. By doubling the dispersion one can approximately get the rifle's performance at 100 m. Using a rest I fired 5 rounds every 7½ minutes (Fig. 19, 20, 21, 22).

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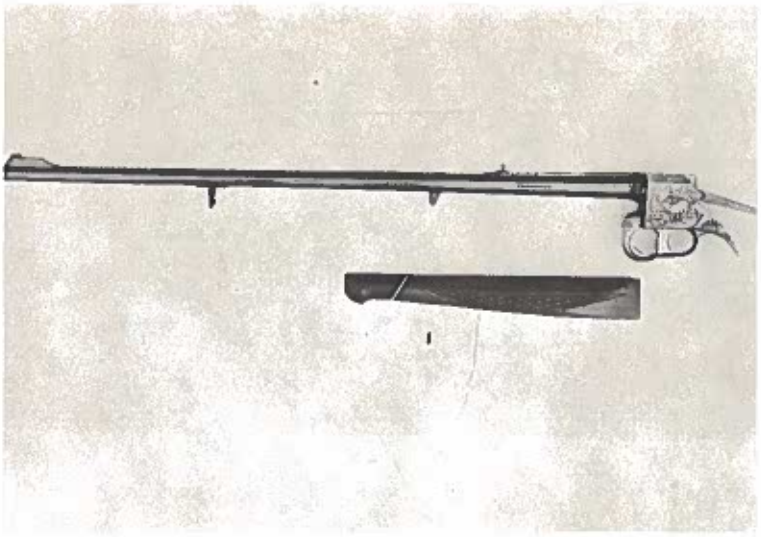

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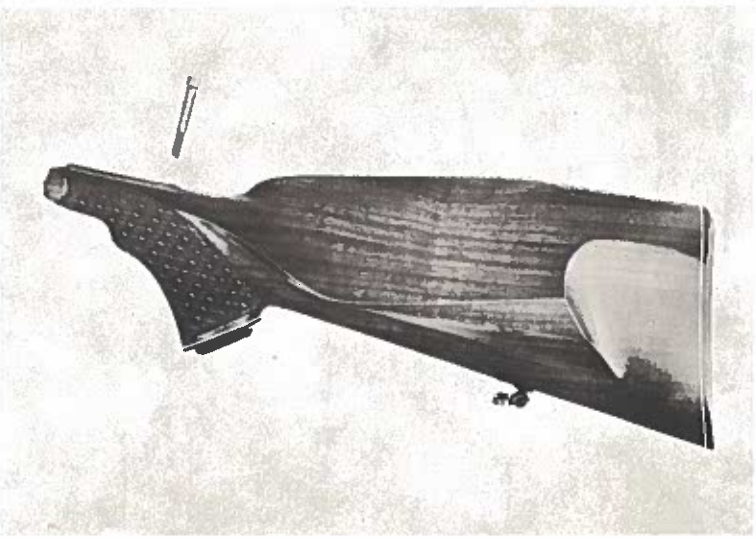

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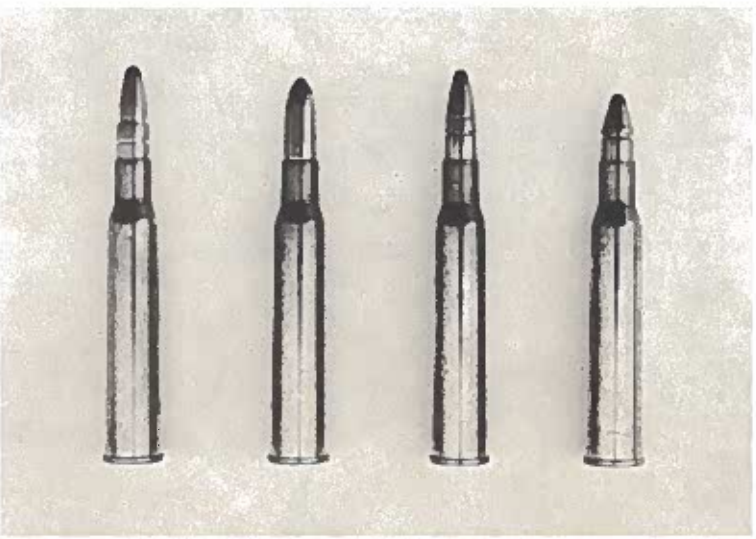


Cartridge	Dispersion at 50 m
7x65 R/TI 11.5 g	1.6 cm
7x65 R/TI 10.5 g	1.9 cm
7x65 R/STA 10.0 g	2.5 cm
7x65 R/TS 6.7 g	2.4 cm

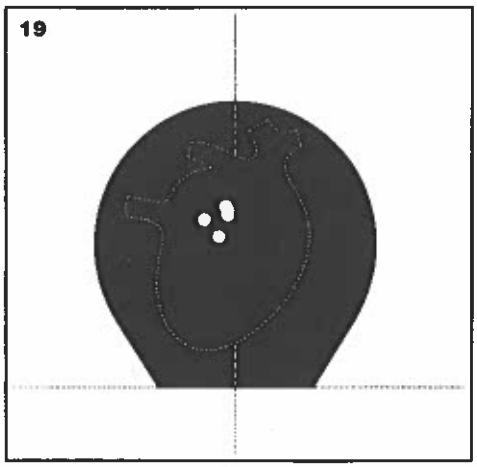
Fig. 16 *Barrel, action and forearm.*
Fig. 17 *Stock with tang screw.*
Fig. 18 *Test cartridges.*

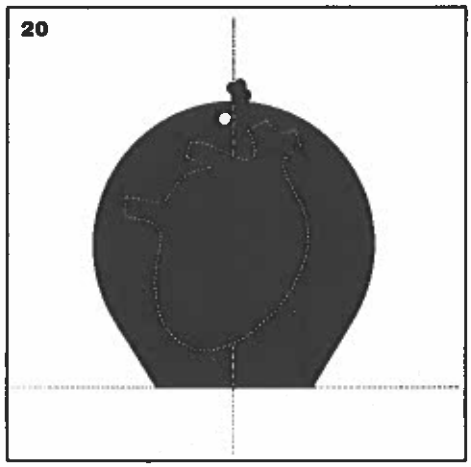
This proves that the Heerenbuchse is deadly accurate indeed. And if one considers the fact that the barrel digested bullets ranging from 6.7 to 11.5 g with about equal skill, it may readily be assumed that other bullets will also go down well. I consider the Heerenbuchse the right gun for the fastidious hunter, especially when scope mounted. Bearing in mind its superb finish, good looks and accuracy, I can thoroughly recommend buying one.

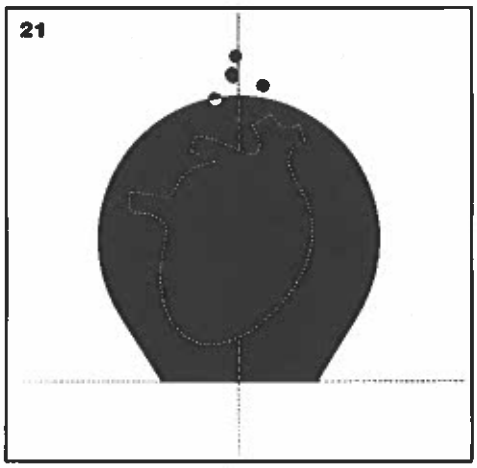
After Colonel Heeren of Baden-Baden was granted patent rights for his dropping block rifle, the firm of Nagel & Menz, also of Baden-Baden, started production. It is not known how many of these rifles were made (in those days all by hand) nor is it known how long production was kept up.

A verbatim translation of the description of the Heerenbuchse as found in Thierbach's Handfeuerwaffen, published in 1886/87:

THE HEEREN-BUCHSE







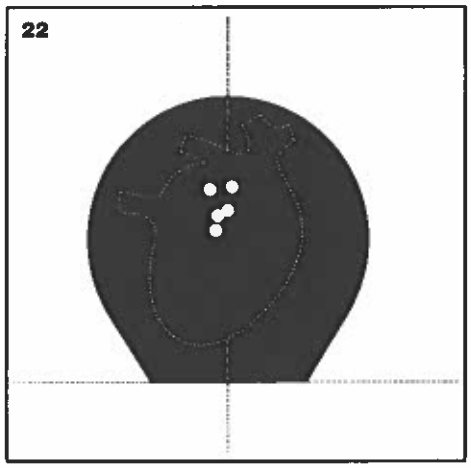


Fig. 19 *1.6 cm dispersion at 50 m with 11.5 g T1 cartridge.*
Fig. 20 *1.9 cm dispersion at 50 m with 10.5 g TI cartridge.*
Fig. 21 *2.5 cm dispersion at 50 m with 10.0 STA cartridge.*
Fig. 22 *2.4 cm dispersion at 50 m with 6.7 g TS cartridge.*

Construction

The Heeren design, Baden-Baden, patented in the year 1880, shows another breech system with dropping block. This model distinguishes itself through its simplicity and small number of parts. The lock and hammer are accommodated on the trigger assembly, whereby the trigger guard is pulled in a downward direction to actuate the breechblock.

Fig. 617 represents a cross section of this locking system in its closed, ready-to-fire phase. As said above, the individual parts are accommodated on the trigger assembly which, in turn, is swivel mounted on a bolt passing through the rear end of the action; its front end being furnished with a holding device so that the trigger assembly can be snapped back into its home position. The left side of the trigger-assembly frame takes the form of a slanting protrusion in between the two parallel side plates of the frame. Starting from the rear, there are the following parts: the hammer spring, hammer and trigger (hair trigger) arranged in such a way that the hammer can be cocked or un-cocked. By pulling down the trigger assembly the hook-shaped protrusion engages in an opening in the breechblock and causes it, on account of the vertical walls of the shaft, to slide downwards, whereby the hammer is cocked by the downward and revolving motion of the trigger assembly. Upon closing, the trigger assembly block returns to its uppermost position, the hammer remaining cocked, bringing the point of the firing-pin to align with the bore so that it strikes the primer when the hammer, on its release, drives it forward with a blow from beneath. A one-armed extractor is housed in the side wall. A sprung locking lug in the breechblock engages in a recess in the side wall when the block has travelled the required distance. Stripping: open the breech, knock out hinge bolt of trigger assembly and draw the trigger assembly down and out, tip breechblock out of the top of the action.

Kärnten.

Only very few hunters and gun buffs will know what historical significance this small, neat town, situated at the foot of the Karawanken mountains, has for the production of small arms. Ferlach, tucked away in Austria's southernmost pocket, perched some 1500 feet high, embedded in nature's paradise in the Dale of Roses, is known more as a holiday and health resort than as a cradle of fine gunmaking. Fine craftmanship and artistic skill are stock-in-trade for these Ferlach gun-makers.

Situated on the boundary between the German and Slav-speaking nations, Ferlach's role was dictated by the plight of the province of Carinthia: in the 16th century, history reports, Venetian and Turkish marauders were systematically terrorizing the area, so gunmaking activities took top priority.

FERLACH — Ancient Home of the Austrian Gunmaker

Günter Mussnig / Karl Hemmrich

The southwest of Carinthia was exposed on many an occasion to Venetian attacks, the southeast, to Turkish forays. Emperor Ferdinand I realized quite clearly how important Carinthia was as a military cross-road, so the City of Klagenfurt was chosen to be fortified. The arsenal was the most important building, but it was not built till after the Emperor's death in 1566.

Here all the weapons were stored for defending the city, as well as those used for fighting in the field.

From old lists we know that this arsenal housed a number of cannon, balls of stone and metal, powder, many sizes of hook guns, pistols, powder flasks, and an array of edged weapons. The other forts and castles were likewise replete with weapons. These forts in Carinthia were built chiefly for defensive purposes and they protected the citizens living in the area.

It is only natural that armed communities were formed with armed guards who were trained to improve their shooting. If the reader would bear in mind that Carinthia had to ward off eight Turkish onslaughts, he will understand Austria's great demand for guns. Skilled gunsmiths were lured to Carinthia by every means, "pipe-fitters" were the cry of the day. Powder making was also suddenly a respectable profession.

When looking around for a suitable site to manufacture guns, it was decided that Ferlach, deep in the Dale of Roses and sheltered in the south by the high Karawanken mountains, in the north by the Drau and Sattnitz mountains, would be ideal. In the east were the foot-hills of the Karawanken, skirted by the deep Freibach valley. In the west Fort Hollenburg commanded an eagle's view across the entire countryside. This fort could control the important Loibl and Drau passes, so Ferlach, at that point in history, just could not have been a better place for making guns. The mountain streams guaranteed year 'round power to run the hammer mills and forges.

Pig iron came from the Carinthian blast-furnaces and charcoal from the giant Karawanken forests. Hence there was no shortage of raw materials.

According to documentary evidence available, the gunsmiths of Ferlach first started work in 1551. However, other gunmakers were in the area, usually working in 1–4 man teams, commissioned by the Emperor himself or by the lords of each castle. Names like Püchsenschmied or Puxenschmied (gunsmith), which often occur in Carinthia, refer to the gun-making profession.

The Ferlach gunsmith, even in those early days, applied the principle of division of labor, according to which one group produced barrels, a second group the locks and receivers, and a third group, the stocks. As far as we can tell it seems as

Austria: Slavonic Border Regiment "Gradisca", Private, 1759

Ferlach was much more famous during the reign of Maria-Theresia than it is today. Ferlach played an important role for Austria during the Napoleonic Wars. However, during the 19th century other gun centres emerged, which became Ferlach's competitors.

Ferlach, Maria-Theresia's Gunsmiths

though Count Dietrichstein, the owner of Fort Hollenburg, organized and controlled all the gunsmiths in the area under authority granted by the local government. Between 1580 and 1600 Ferdinand I hired foreign gunsmiths (a number from Belgium) as the Austrians simply did not have enough qualified people to produce all the guns wanted. Nevertheless, today there are no foreign names in the Ferlach area. It is most likely that the foreign workers returned home after their work was done.

The Emperors's determination to drive off the Turks, and others, from his country's borders, provided the Carinthian gunsmiths with bread and wine. An order from the Carniolan arsenal in 1558 shows that the Ferlach gunsmiths had produced 400 double hook guns and 400 hand cannon within the year.

In addition to the many types of military weapons, the Ferlachers still found time to produce sporting guns. Between 1589 and 1590 a number of deer guns with rifled barrels were made. Rifling was a tremendous improvement on the smoothbore with regard to accuracy. Here one must come to the conclusion that rifles, contrary to smoothbores, at least in Carinthia, were used for sporting purposes long before the military got interested.

Apart from producing guns, dealers in Ferlach also sold them. Large orders not only came from Austrian arsenals, they came from commanding officers of regiments that had moved into positions at the front, too.

It was during the Thirty Years' War that prevailing conditions forced the Ferlach gunmakers to found a guild, confirmed on June 14, 1631 by the owner of Fort Hollenburg, Count von Dietrichstein.

They had realized that strict controls were necessary where such large numbers of guns were being made. A decree was issued that all finished weapons, including those for hunting, must be subjected to checking by a qualified comptroller. Weapons that passed the inspection were proof stamped, and the buyer was obliged to pay a fee to the gentlemen of Fort Hollenburg. Guns bearing these proof marks became a symbol of quality throughout Europe, and were readily sold. This proof stamping was the forerunner of today's proof marks.

Under Empress Maria Theresia, Ferlach experienced its heyday, owing largely to the Seven Years' War.

A document from 1750 lists in Ferlach twenty-one master pipesmiths, 119 master locksmiths, and thirty master gunsmiths. During this period Maria Theresia awarded 308 "Master Titles", and confirmed the statutes of the guild. To attain a "Master Title" the aspirant had to serve an apprenticeship, travel around as a journeyman, and spend two years with a Ferlach master gunsmith.

On founding the Gunsmith's Rifle Corps, which was vested with royal privileges, the Empress, as part of the big celebration in Klagenfurt, presented the Corps with a silk flag bearing the Austrian double eagle and promoted the commander of the corps to the rank of officer. Of course, there were good reasons for these privileges when one considers that the Ferlachers delivered to the arsenal in Vienna, between 1772 and 1778, a total of 2000 carbines, 400 shotguns, 20,000 pairs of pistols, 8000 Dutch carbines, 2000 improved carbines and 2000 spare barrels. Austria's ally, Spain, also imported guns from Ferlach. Soon it became necessary to build a gun depot at Görtschach, west of Ferlach, where an officer with thirty men was responsible for the proving and storing of the weapons.

Before long the industrious gunsmiths of Ferlach had made their village famous. In Europe, Ferlach was undoubtedly once better known than it is today.

Fresh Competition arose in the 19th Century

Ferlach played an important part in the Napoleonic wars. Between 1800 and 1814 some 300,000 military weapons were made. Twenty-two barrel-making units were in full production.

However, when a gun factory was set up in Vienna in 1842, Ferlach's output sank rapidly. Probably Ferlach's geographical position was, in times of peace, more a hindrance than a blessing. Moreover, especially in other countries, guns were no longer being hand made. It was not long before Ferlach felt the icy grip of this competition.

Other countries realized at an early stage that machine tools were the only answer to increased production. In no other way could the great demand for military firearms be satisfied.

In 1859 the Ferlach gunmakers received their last big order for military weapons. Since then they have specialized in the production of high-class sporting weapons. Nevertheless, this huge army of gunsmiths soon discovered to their sorrow that they could not live from guns alone, so they turned their attention to household utensils. Thus many a master gunsmith, a specialist in creating superb hand-made guns found himself hammering out wick snuffers for petroleum lamps, or coffee grinders, to keep his family above water!

In 1842 a firm in Klagenfurt started to export guns and hardware from Ferlach, and even set up a factory branch in Klagenfurt, but by 1872 the firm folded.

At last a silver lining in the gloomy sky of the Ferlach gunsmiths was seen when Austria decided to convert her muzzle loaders to breech loaders, a consequence of the 1866 war with Prussia. At least for a time the Ferlachers could return to their own trade.

In four years Ferlach produced 10,440 double-barrelled guns, 7,336 rifles, and 7,608 pistols, a number of which were exported to Rumania and Serbia. But retrogression in the production of military arms could no longer be endured.

"What's to be done?" the Ferlach gunsmiths asked themselves. And together they determined: "We shall make sporting arms unsurpassed in beauty and quality."

This was a plan that came to fruition, and Emperor Franz Josef I declared Ferlach's sporting guns to be the very best. Heeding this royal "verdict", the public authorities supported the Ferlach gunmakers when and wherever they could.

In 1878 the first Austrian gunsmithing school was established. In 1882 a state run Proof House, and in 1884 a test range at Ferlach were opened. The school was a great success.

In 1885 a co-operative was founded that set itself the task of modernizing gun production. However, despite these technical advances, each master gunsmith was in charge of his own affairs. On a co-operative basis parts such as barrels, stocks, receivers, breechblocks, triggers, etc. were semi finished. It was not until 1887 that the first mechanized workshop was set up at Ferlach. But final fitting and finish was still the domain of the master craftsman. As a co-op member, the private gunsmith financially supported the main mechanized work-

School for High-Grade Gunsmithing in Ferlach

The work of an engraver who is learning his trade at the Ferlach school.

shop by ordering all semi-finished parts from there.

At the beginning of the 20th century new Ferlach sporting guns gained a fine reputation, for they won a number of prizes at international exhibitions. Today, Ferlach master craftsmen are convinced, and quite rightly so, that the supreme quality of their weapons rests on generations of tradition.

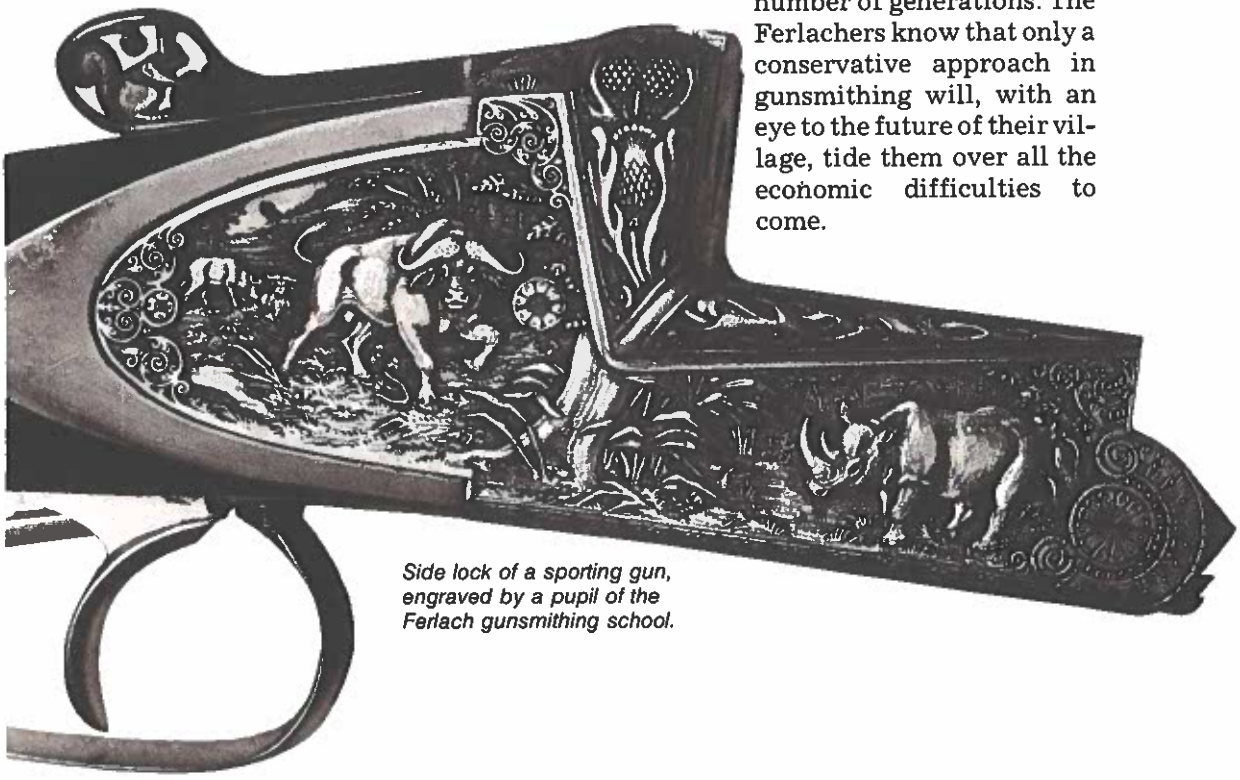
In 1970 there were twenty-one master gunsmiths at Ferlach, employing a staff of 200 gunmakers.

For Ferlach the period of military guns will have probably passed forever. The visitor to this lovely village, just under 17 km south of Klagenfurt, would never suspect a gunmaking industry. What with traditions on the one hand, and with old machines on the other, an eye for perfection and a steady hand are a must for one to be recognized as a gunsmith at Ferlach. To be an engraver at Ferlach one really has to be an artist. Engravings and inlay work of gold and silver from the Ferlach workshop can probably not be surpassed by any other artist in the world. Despite hand work, technical finesse is truly remarkable. The hunter can have his rifle or shotgun made to measure. Many a prosperous client arrives with special wishes, so it is often necessary for the Ferlachers, after much cogitation, to design completely new elements for the trigger, and stock breechblock mechanisms. Apart from the normal over-and-unders, double-barrelled shotguns, rifles, etc. four and even five-barrelled combination guns are sometimes ordered, and made . . .

Needless to say, the materials and finish of Ferlach weapons are peerless in every respect.

Today Ferlach Produces 5000 Quality Guns A Year

Anyone who realizes that a team of gunsmiths requires a month to build a first-class gun, will appreciate that the Ferlachers cannot produce more than 5000 a year. To the connoisseur these guns are jewels that will retain their value for a number of generations. The Ferlachers know that only a conservative approach in gunsmithing will, with an eye to the future of their village, tide them over all the economic difficulties to come.



Side lock of a sporting gun, engraved by a pupil of the Ferlach gunsmithing school.

AUSTRIAN SOLDIERS

The FG42

Hans-Joachim
Kaltmann

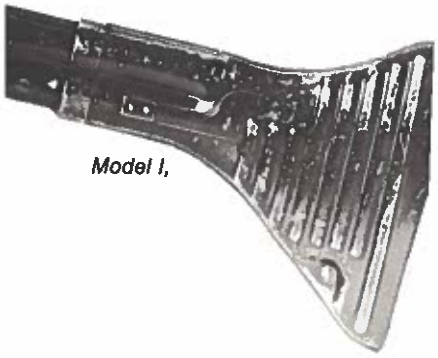
Paratrooper Rifle

The FG 42 is but a fragment of the history of Rheinmetall-Borsig; for at the factory in Soemmerda/Thuringia, Louis Stange, chief engineer and father of the FG 42, conceived a host of small arms of revolutionary military design, including the MG 13 Dreyse, MG 15, MG 17, MG 34 and MG 131.

In the Germany of 1939, the Paratroopers were the youngest and most modern arm of the Wehrmacht. Yet modern weapons for these units were not forthcoming. These airborne divisions had to accomplish their combat missions, without supporting artillery, with only the MP 40 and the Kar. 98 k bolt-action rifle. Capturing occupied Crete from the air was a military accomplishment without parallel; but the high number of casualties determined the Luftwaffe (the paratroopers were attached to the Air Force) to look into the prospects of having a special assault-type rifle designed to meet the requirements of troops fighting deep in enemy territory without support from their own lines. The Luftwaffe approached the following firms:

Gustloff-Werke
Mauser-Werke
Grossfuss
Haenel
Krieghoff
Rheinmetall-Borsig

A contract for developing this new weapon was awarded to each of these companies at the same time; with a very short deadline, as one might imagine. It was thought that the feeling of rivalry between these competing companies would spur them on to a quick success.



Model I,

Model II,

Model III.

Its history and development from beginnig to end.

A Rheinmetall product.

The required characteristics of the new rifle were set down as follows:

1. Cal. 7.92x57 mm, unlimited use of all available special-type ammunition.
2. Semi and fully automatic fire.
3. Positively locked breech.
4. Light machinegun capability.
5. 10 and 20-shot magazines.
6. Rapid change-over from open to optical sights.
7. Fitting for bayonet.
8. Muzzle brake, compensator and flash hider.
9. Maximum overall length: 1 m.
10. Maximum weight without magazine and accessories: 4 kg.
11. Capability for launching grenades.
12. Manganese steel, carbon steel, and other hard-to come-by materials may not be used.
13. As far as possible use of DIN-standardized *) raw material and semi-finished products (screws, rivets, pins, etc.)
14. All parts of the rifle must be made with available machine tools, no new tooling may be produced.

In order not to choke the production facilities of these companies, and to unshackle design and constructional engineers for other projects, only the 4 most promising drawings were accepted for the manufacture of prototypes.

*) German Industrial Standardization

When the first models were submitted to the Weapons Office of the German Air Force, it was the first time that the representatives of industry could compare the different approaches by the various companies. However, these representatives were not al-

FG 42 Model I Rheinmetall

FG 42 Mod. I. Right-hand view showing open bolt through ejection port (magazine removed).

Magazine opening.

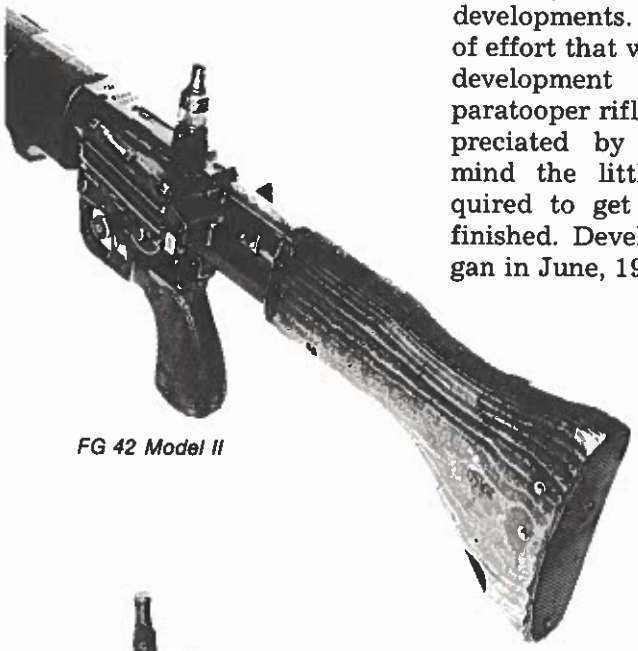
FG 42 Model II

FG 42 Model III

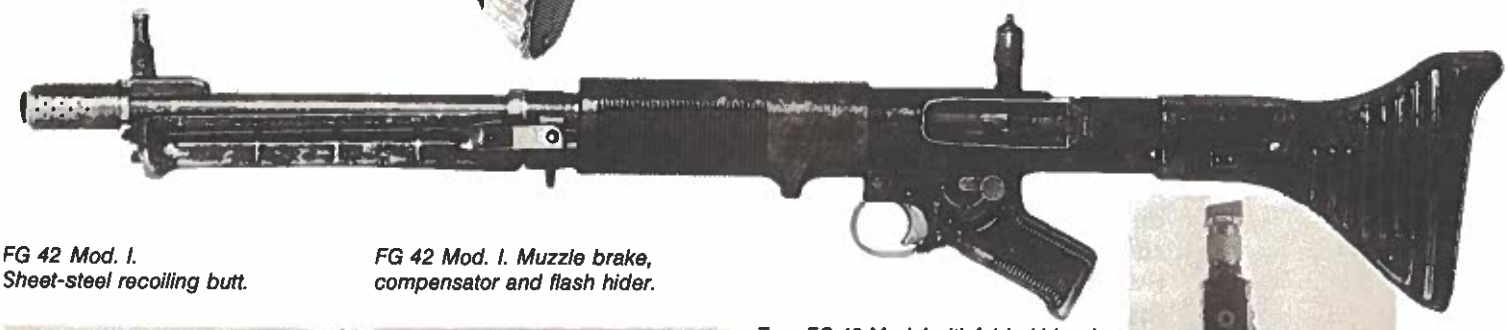
FG 42

lowed to attend the actual performance tests. The Air Force decided that Rheinmetall-Borsig had designed the best prototype, and consequently entrusted that company with all further developments. The amount of effort that went into the development of this paratooper rifle can be appreciated by bearing in mind the little time required to get the project finished. Development began in June, 1941, the prototypes were presented in April, 1942, and the first three finished rifles were demonstrated in June, 1942. As a prototype this weapon was known as the LC-6; later, when Hitler himself and some of his personal staff had fired the new longarm, and nothing but praise for the weapon had come from the Air Ministry, Hitler commanded that the rifle be adopted by the Air Force and designated it the FG 42.

There was little or no cooperation between the services of the armed forces, hence each group was compelled to provide itself with equipment believed to be the most suitable for the task in hand. The Army, which was never

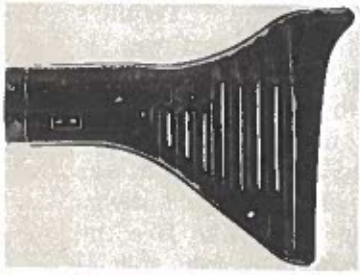


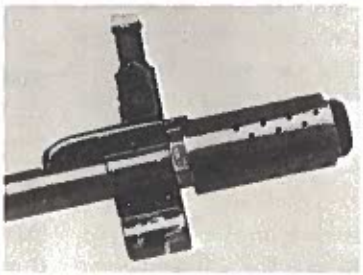
FG 42 Model II



FG 42 Mod. I. Sheet-steel recoiling butt.

FG 42 Mod. I. Muzzle brake, compensator and flash hider.





Top: FG 42 Mod. I with folded bipod.

Bottom: FG 42 Mod. III. Note bipod is now hinged at rear of the muzzle.

Folding post sight for sniping and automatic fire.

on particulary good terms with the Air Force, rejected the FG 42 to press ahead with their own MP 44, also know as Sturmgewehr 44. The Army had come to the conclusion that the long-range 7.92x57 mm cartridge was not necessary for average targets at 400 m. This was revolutionary thinking at the time and introduced the now accepted trend towards the short cartridge. However, in 1942 Hitler was not in favour of the idea at all: there were far too many Kar. 98 k bolt-action rifles in the arsenals, plus ammunition, so pipsqueak loading for military use was out of the question!

The FG 42 received unlimited praise from the troops wherever it was used on the front. Whereupon the Weapons Office placed an immediate order for 100,000 of them. Since Rheinmetall-Borsig did not have the capacity to produce large batches at such short notice, Krieghoff-Suhl was delegated to perform the task.

FG 42 Mod. I, which complied with the 14 required characteristics set down by the Air Ministry, was proved, after first-hand battle experience, to be too light for the powerful 7.92x57 mm cartridge, and too lightweight to stand up to the rigors of paratroop drops and front-line fighting.

FG 42 Mod. II, lost much of its original streamlined appearance through reshaping of the pistol-grip, forearm, butt, etc. Experience gained from the war on the East front made it necessary to replace sheet-steel parts with wood where the soldier's hands or face came into contact with the weapon. The bipod was strengthened and hinged at the muzzle. The magazine opening on the side of the receiver was fitted with a dust cover, and a deflector was mounted behind the right-hand ejection port to facilitate firing by southpaws. Furthermore, the angle of ejection was turned to the front to stop the shower of spent cartridge cases from splattering down on the neighbouring gunner. The muzzle brake and compensator were redesigned, but since these improvements did not suffice to sufficiently reduce the heavy recoil, the total weight of the FG 42 Mod. II was increased from 4.15 to 4.82 kg. The cyclic rate of fire was also reduced by increasing the weight of the bolt. A 3-port gas regulator was incorporated, too, for using the gun in various climates.

FG 42

The diagonal pistol grip, designed for firing the weapon at an angle to the ground when descending by parachute, was straightened out for normal military use, and the safety underwent a change.

Despite all these improvements the FG 42's recoil was still too heavy for bursts to be fired from the shoulder. In Mod. III the FG 42 was increased in weight to 4.98 kg. However, this increase in total weight still did not supply the answer.

The weight of the bolt rose from 510 g in Mod. II to 595 g in Mod. III. Moreover, the recoiling stock was provided with a longer travel and a softer spring to help reduce the kick. Although the FG 42 was battle-tested and was popular with those who used it, only about 6000–7000 of the rifles reached the troops, owing chiefly to lack of materials, personnel, and allied raids. The Army's MP 43/44 that had been initiated before the FG 42, had, in the meantime, rid itself of teething problems, and was in full production.

However, the war effort had reached a point where Germany, occupying a huge slice of Europe, could no longer furnish regular troops to hold the fronts. Hitler's only alternative was to arm the civilian population with a cheap sub-machine gun for home defense. The "People's Shooter" (Volkssturm) is noteworthy for its simplicity in design and cheapness in manufacture. It lacked a locked action, was made of stampings, but was strong enough to fire the powerful 7.92 mm special cartridge. On the one hand, these Volkssturm represented a revolutionary advance in low cost gun manufacturing; on the other, a step backwards in regard to the sweeping changes in gun technology ushered in by the FG 42, MP 44, MP 38, etc.

Its operating principle

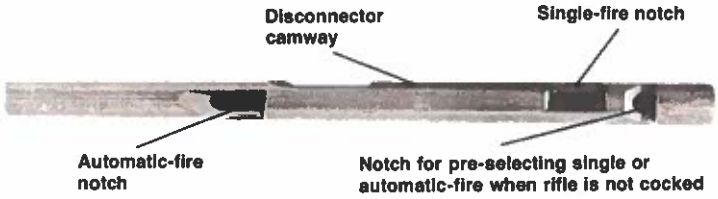
The FG 42 is a gas-operated weapon with a fixed barrel and a rotating bolt with two locking lugs. When the rifle is cocked the selector control forces the sear into one of two notches in the underside of the bolt carrier. When engaged with the rear notch the bolt remains open for automatic fire; when engaged with the forward notch the bolt closes for single fire, thus giving maximum accuracy. To take advantage of this ingenious system, the carrier had to be placed under the bolt, and the magazine side mounted. Fig. 1 depicts the notches in the bolt carrier. Viewed from right to left the first notch, having no side walls, permits the sear to move laterally for pre-selection of single or automatic fire when the rifle is not cocked. The centre notch is for single fire, as there is a camway running to the left that acts as disconnector. For each shot the trigger has to be pulled once. Now the attentive reader will ask how the sear can possibly move laterally when engaged with the centre notch, which has a sidewall. If you would look carefully at Fig. 2, you will see that the sear is positioned on the left for single fire. A sprung plunger housed in the selector knob will be seen protruding against the sear assembly. When the selector is swiveled from single fire to automatic, or vice versa, the plunger is pulled out of the receiver via the milled

head of the selector knob. In Fig. 3 this plunger is holding the sear over to the right. In reality, though the nose of the sear is still engaged with the centre, single fire notch of the bolt carrier, it can only be tensioned, but not laterally moved, because of the left-hand wall.

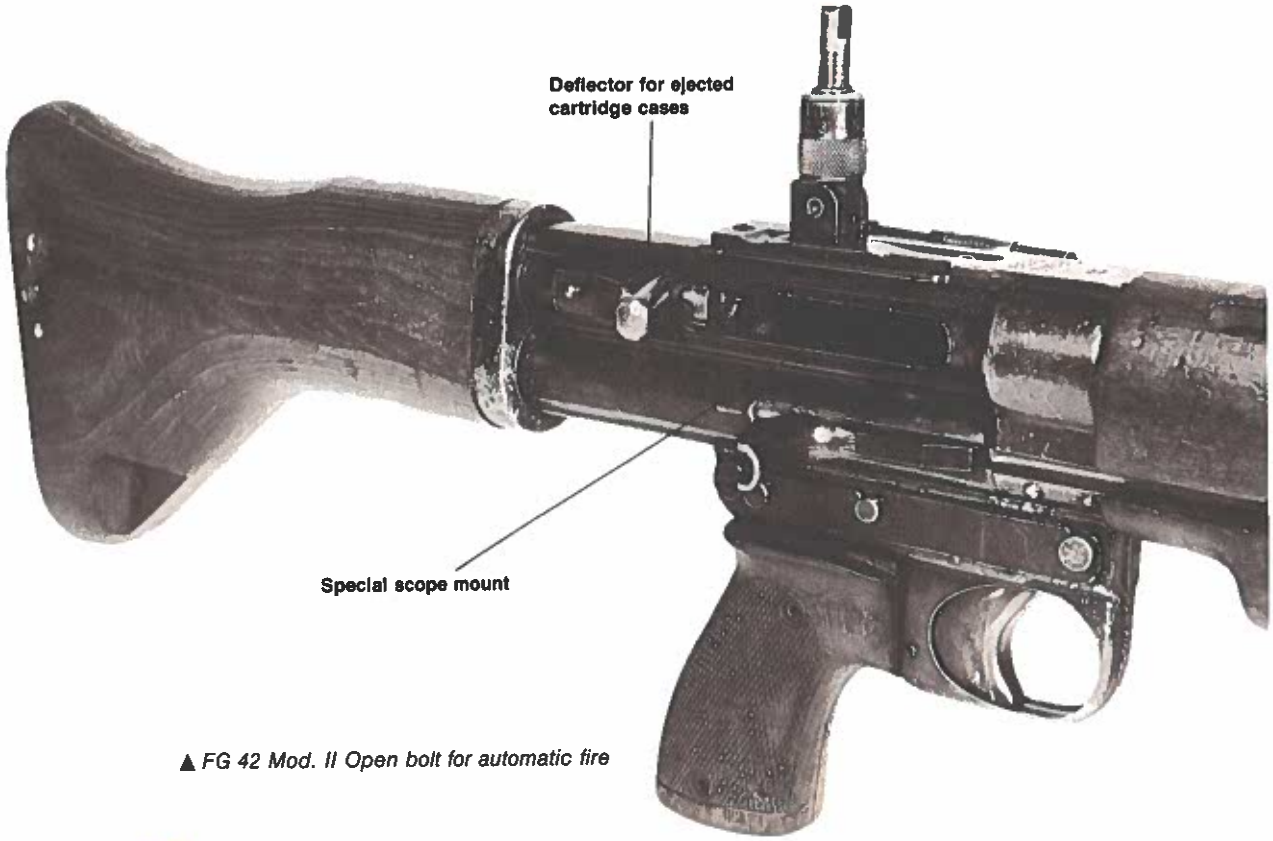
Once a shot has been fired, though, the sear is drawn out of the notch and clear of the wall. The plunger in the selector knob can now force the sear to the opposite side which engages with the automatic-fire notch at the far left, since its wall is not on the same side as that of the single-fire notch. As the automatic-fire notch is not provided with a disconnector camway, the rifle continues to fire until the magazine is empty, or the trigger is released. When

the sear is engaged with the automatic-fire notch of the bolt carrier, the bolt remains open as in the MG 3. Depressing the trigger allows the recoil spring to drive the bolt home, whereby the end face of the bolt strips the top cartridge from the magazine and thrusts it into the chamber. The bolt with its two front lugs is turned and locked into the breech recesses when the firing-pin support on the bolt carrier, also travelling in a forward direction, causes the bolt to rotate on account of its curved camway. At the end of this curve the camway straightens out for about 14 mm, along which the bolt carrier and attached firing pin continue to travel until the firing pin strikes and ignites the chambered cartridge. When the expanding gases impinge on the piston head of the bolt carrier the bolt carrier travels these 14 mm rectilinearly before the

Fig. 1


Disconnector camway
Single-fire notch
Automatic-fire notch
Notch for pre-selecting single or automatic-fire when rifle is not cocked

▲ *FG 42 Mod I The bolt carrier*



▲ *FG 42 Mod. II Open bolt for automatic fire*

camway curve begins to unlock and open the bolt. This precautionary measure ensures that the breech is locked at the time of the explosion, and that it remains locked until the bullet has left the barrel and dangerous gas pressure has dropped to safer limits.

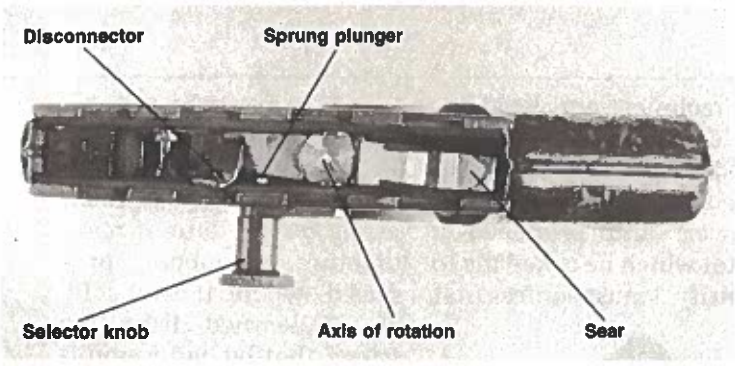
When firing single shots the cycle is the same, or nearly so; the only difference is that the trigger sear engages with the single-fire notch of the bolt carrier, and, owing to the disconnector camway, carrier and bolt remain poised till the trigger is pressed.

When the magazine is empty it is replaced with a full one, and the rifle is cocked by hand for the first shot. In the FG 42 Mod. I the magazine follower acts as a last-round stop and holds the bolt open after the last shot has been fired. In Mod. II and III this arrangement was discontinued.

FG 42

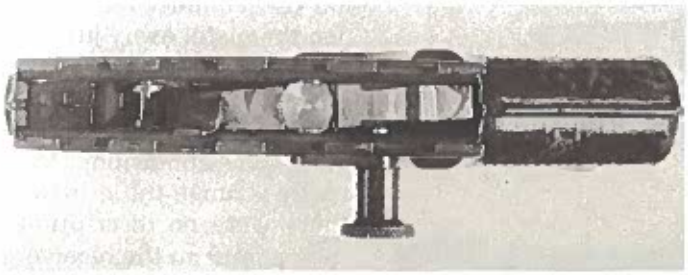
The buffer, which is bayonet fitted in the housing, serves two functions. Its front surface absorbs the jarring blow of the opening bolt and also helps to accelerate it on its return journey; the rear surface of the buffer absorbs the gun's recoil in conjunction with the sprung, sliding butt. The main disadvantage of the muzzle brake assembly, page 145, was its popping explosions, deafening to all within earshot. The wall thickness of the muzzle brake is only 3 mm and the vent-holes measure 1.6 mm. In the FG 42 Mod. II and III the number of vent-holes was increased to raise efficiency. Furthermore, the vent-holes were redesigned to allow escaping gas to leave the brake in a forwardly direction, thus reducing the popping explosions as much as possible.

2

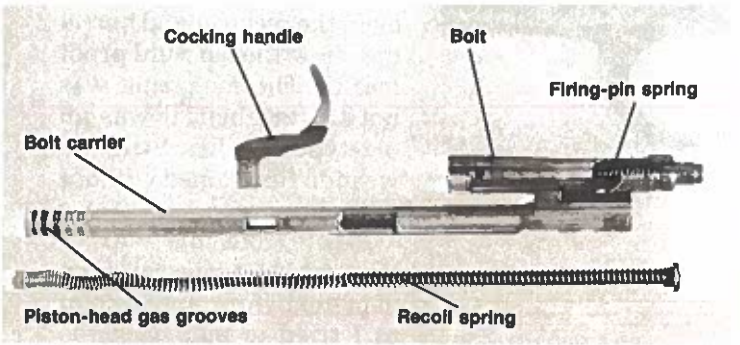


▲ *FG 42 Mod. II Sear positioned to the left for single fire*

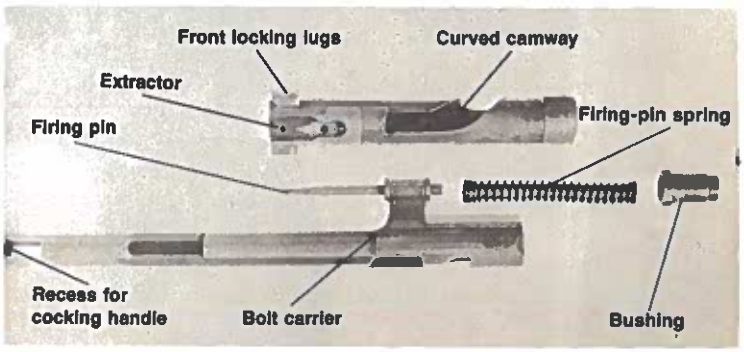
3



▲ *FG 42 Mod. I Sear positioned to the right for automatic fire*



▲ *FG Mod. I Complete bolt assembly*



▲ *FG 42 Mod. I Bolt and bolt carrier stripped*

Text and Photos:
Dr. Blatter

Schwarzlose Pistol

IDENTIFYING A WEAPON

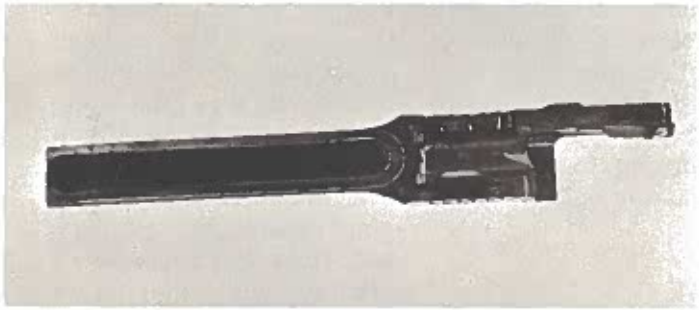
The day started just like any other. There was nothing in the air to tell me that something unusual would happen. In the evening I visited friends who share my hobby to discuss with them the technical and legal aspects of weaponry. All of a sudden one of my colleagues stood up, opened a drawer, and produced a pistol which he asked me to identify. I must confess that I had been caught out this time, as, strictly speaking, I was unable to give the history of the pistol, or model, producer, date of manufacture, numbers produced, where it was sold, etc. I learned from my friend that he had found it in a piece of furniture that he had inherited. Its original owner must have hidden the pistol away just after the war. There were a few spots of rust on it, but otherwise the weapon was in good condition. The really strange thing is that there were no inscriptions to be found on the receiver, barrel or elsewhere. Yet the original browning had not been tampered with. However, the receiver and barrel did show the old Suhl proof marks. The magazine was not the original, it was an old-type Walther. Still, the weapon functioned without a hitch.

Action open/action closed

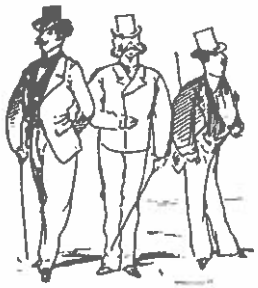
Right from the start I thought I had seen this type of pistol before, and as soon as I tried to pull back the slide I realized that it must

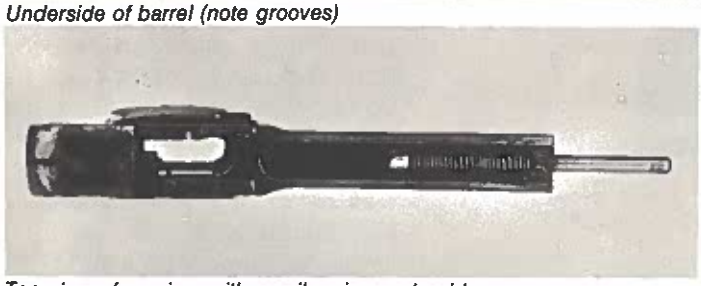
Action open/action closed (safety "off")

W. Schwarzlose had the barrel of his pistol go forward for cocking and ejecting

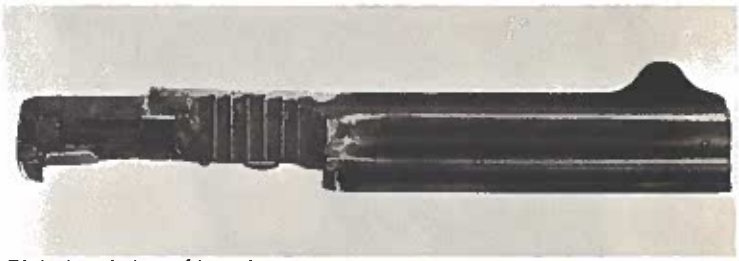


Underside of barrel (note grooves)

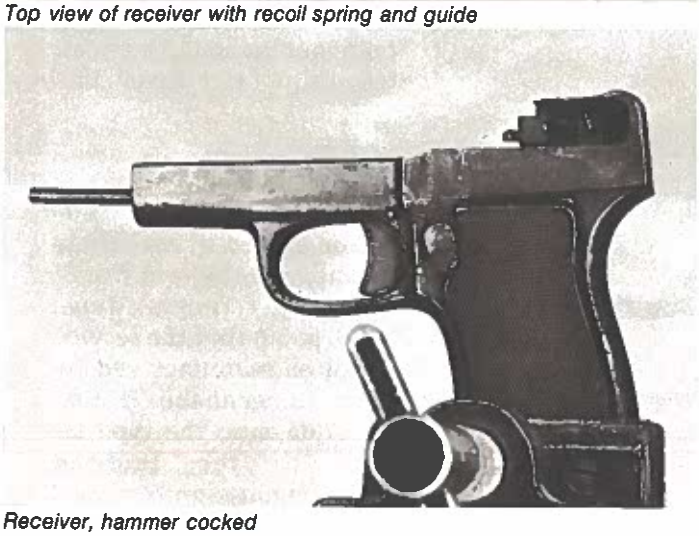




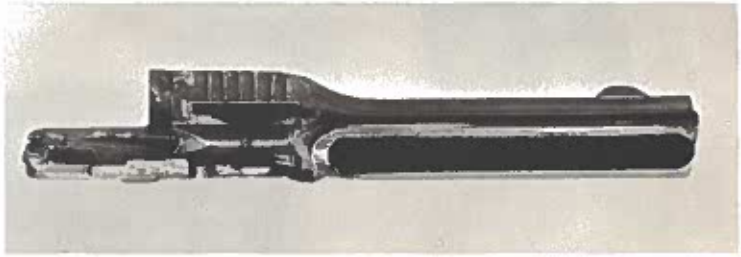
Top view of receiver with recoil spring and guide



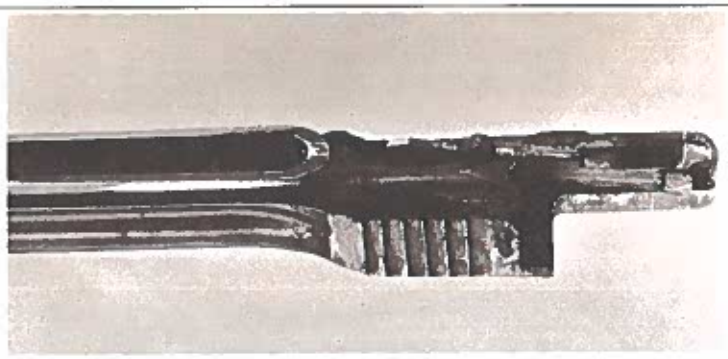
Right-hand view of barrel



Receiver, hammer cocked



Oblique view of underside of barrel



Sear mechanism

be one of the Schwarzlose models. Later, when I was alone and had more time to devote to its identification, I found my assumption confirmed in American literature. Unfortunately, the original German documents had been lost during the war. As the Schwarzlose pistol is of freakish design, its case history will undoubtedly interest gun historians and collectors.

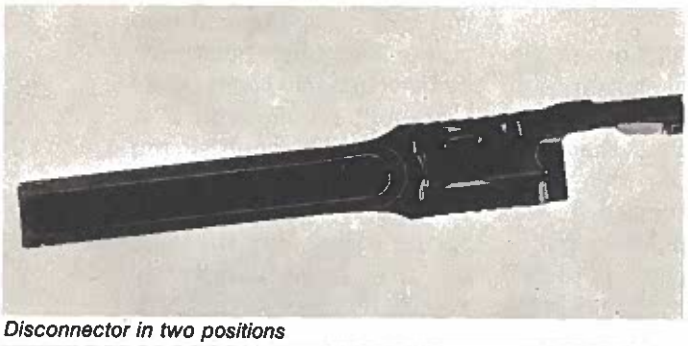
Just prior to 1908 A. W. Schwarzlose was busy in Berlin designing an automatic pistol whereby the slide did not fly to the rear after each shot, his idea was to reverse the procedure and have the barrel and slide follow the direction of the bullet. Hence the term "blow-forward" instead of "blowback" type.

According to historians this was the only pistol of its kind that was commercially successful. Nonetheless, for obvious reasons it soon disappeared and no copies of this system have been marketed since. W. H. B. Smith was of the opinion that the underlying idea of the designer was to have something solid behind the barrel so that the slide could not fly into the firer's face, should the anchoring ever break. He may have a point there, but perhaps not. There was a number of other designs of that period that had been proven unsafe. Smith mentions the first Colt .38 automatic as an example. However, after Colt had had the anchoring bolt strengthened, there was never any more trouble. Pistols of a later date were also made with a slide anchoring bolt. Still, I must point out that our American friends do not favor this construction. W. B. Edwards opined in his article "Handguns of World War I" (Shooting Times, June, 1955, p. 50) that the service pistol as manufactured by Fritz Langenhahn & Co., cal. 7.65 mm, the type issued to the Prussian machinegun units, also

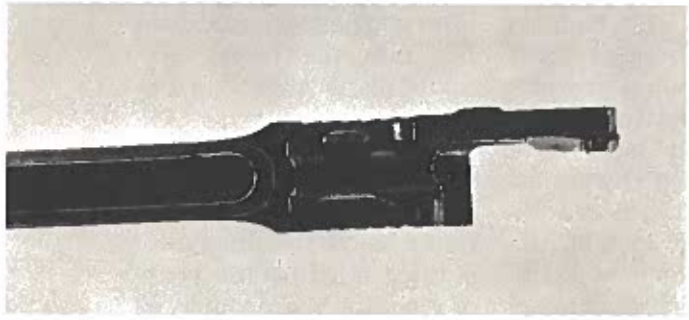
Hull being ejected

Receiver

Schwarzlose Pistol

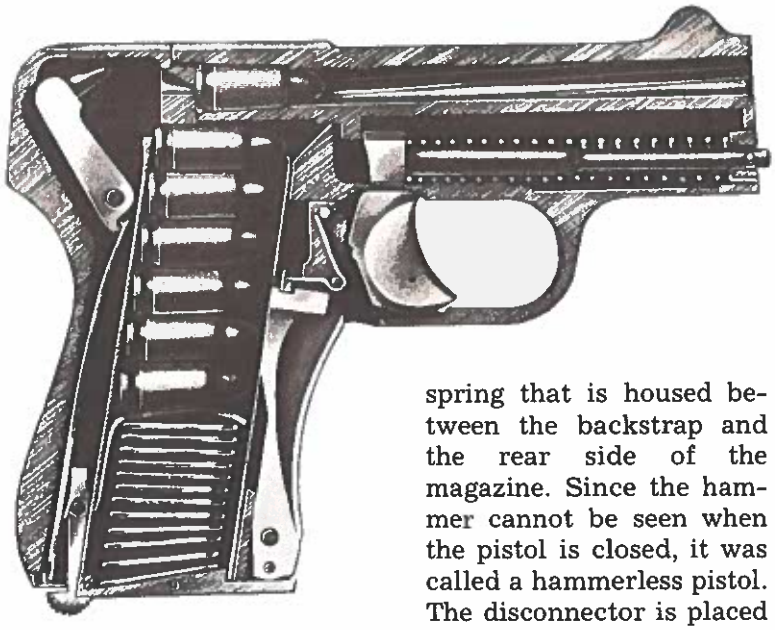


Disconnector in two positions



suffered from this disease. However, he had to admit that the slide only blew off at the back if the anchoring bolt had loosened. As he also ran down the Mauser pistol in the selfsame article, that notoriously tough model of 1896, saying it was also weak behind the barrel, I do not think it necessary to heed his criticism. It is of little consequence to the collector why Schwarzlose should choose the method he did and no other. According to the illustrations I have found, various versions of the Schwarzlose pistol must have been made. The main differences being the grips, a grip safety and a 2 cm sprung extractor which is externally visible. W. H. B. Smith writes that this pistol was sold throughout the world by a mail-order house for 15 US dollars between 1908 and 1915. In his book Mathews adds that these pistols in the USA were stamped: "A. W. Schwarzlose GmbH, Berlin" and "Imported by Warner Arms Corp." Smith lists the weapon as measuring 5½ inches, barrel 4⅛ inches and weighing (I assume unloaded) approx. 20 oz. The magazine had a capacity for 7 cartridges, there is no mention of a longer magazine. When discussing this pistol with a gunsmith who was an armourer in the German army during World War I, I learned that after 1920 the Schwarzlose appeared on the market without inscriptions.

The model under discussion is probably one of these, if it was not a prototype. All the Schwarzlose pistols have a receiver of one piece forging. It contains all the recesses and openings necessary for the trigger mechanism, slide and safety-catch parts, etc. The recoil spring and guide lie under the barrel and help hold it in place. The magazine is inserted in the normal fashion, i. e. by slipping it through the opening in the butt. In the European models the magazine catch is situated at the bottom. Smith and other Americans, however, describe the models marketed in the US as having a magazine catch on the left-hand side of the grip (like the .45 Colt). The barrel which is not longer than the receiver, fits very tightly in its guide grooves. The inside hammer is tensioned by a flat

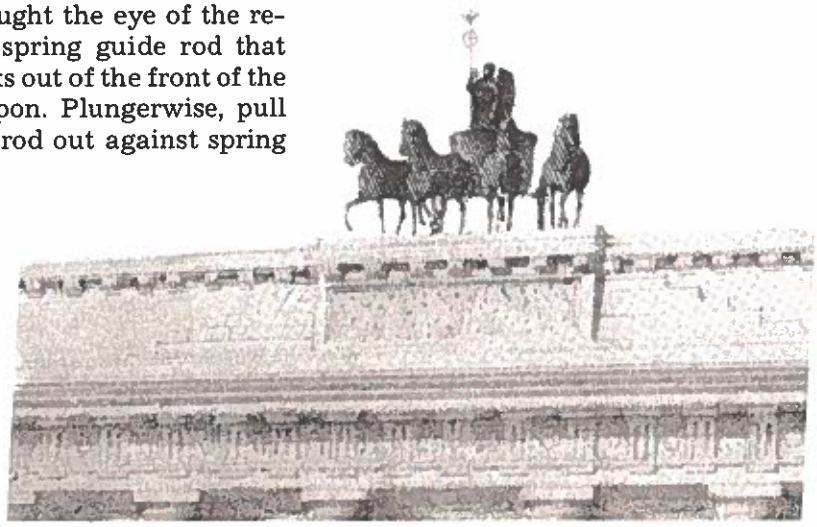


Cross section of the Schwarzlose

spring that is housed between the backstrap and the rear side of the magazine. Since the hammer cannot be seen when the pistol is closed, it was called a hammerless pistol. The disconnector is placed under the barrel and prevents "double shooting"; in other words the hammer cannot be dropped again until the breech is properly closed and the trigger has been relaxed before the next pull. The Schwarzlose was not fitted with an additional breech locking device, as the design of the receiver retards breech opening somewhat.

The Schwarzlose can be disassembled by running a punch or similar object throught the eye of the recoil spring guide rod that sticks out of the front of the weapon. Plungerwise, pull this rod out against spring pressure as far as it will go, that is, until there is an audible click. The foot of the rod will have engaged in a recess. The barrel can now be lifted off in a forward direction. I recommend that you leave the recoil spring and guide where they are; for replacing a powerful spring is not only tiresome but also a bit dangerous. Another way of stripping is to push the barrel forward until you hear the guide rod fall into the recess. Assembling is slightly more tricky.

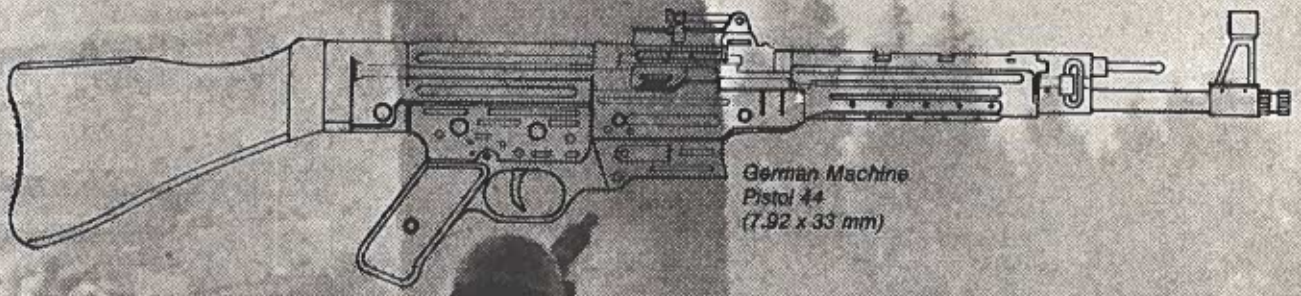
Despite its excellent finish it is evident that a pistol of this design can never be outstandingly accurate, or withstand years of gruelling use. As likely as not jamming will be very common with this type of pistol.



The Schwarzlose pistol was developed by Schwarzlose in Berlin in 1908. Despite its interesting design and excellent finish, it is evident that this type of pistol can never be outstandingly accurate, or withstand years of gruelling use.

The Evolution of the Assault Rifle since W W II

German paratrooper's FG-42



German Machine Pistol 44 (7.92 x 33 mm)

An Historical Outline

By M. Winter

It all began at the end of World War II. The infantry weapons developed by the Germans during the closing years of the war – such as the paratrooper's FG 42, the assault rifle 43/44 and type 06, the so-called Sturmgewehr 45, which was still being developed and tested by Mauser – caused a sensation in military thinking all over the world. Here, for the first time, was a pointer to the infantry rifle of the future. The new, short cartridge in calibre 7.92 x 33 mm was also indicative of the fact that big-game cartridges are unnecessary when shooting sparrows. In other words: your enemy can't be deader than dead!

Assault Rifle

Just prior to the end of the war the USA conducted tests with a short cartridge form, the .308 Winchester, also known as the T 65. After 1945 all states boasting an arms industry quickly turned their attention to the design and production of automatic rifles, exploiting what information they could from the German forerunners. A dramatic race began. Some nations ran in a circle, other even backwards. The Americans had developed the T 20 by the end of the war; a version of the Garand rifle, 20-shot magazine, with single and automatic fire. But when WW2 came to an end, the order for over 100000 of these rifles was cancelled. Later, in an improved version, it became known as the T 22 E2.

In England the ISACP (Ideal Small Arms Calibre Panel) was formed to determine which factors were worthy of consideration for developing and manufacturing a new cartridge, as well as a new rifle to replace the Enfield .303.

At the same time SIG, Switzerland, introduced their semi-automatic Karabiner SK-46 and FN, Belgium, came out with their semi-automatic rifle SAIVE, which, outwardly, looked something like the Russian Tokarev 38 model. And Madsen, Denmark, marketed the semi-automatic Ljungman 49. The Soviet Union was the first country to make effective use of the military experience she gained during the war. As in Germany, the Russians likewise risked introducing, alongside the standard infantry cartridge, a second type of ammunition, the 7.62 x 39 mm short. Around this new cartridge the Soviets then introduced their semi-automatic SKS 1946.

In the meantime the subject cartridge/rifle was ardently being discussed in England and America. It seems that the English had floated the ISACP while under the impression that they and the Americans would exchange information on progress made. That is why they kept the Americans up to date on what they were doing. Thus the English specialists arrived in the USA with the fruits of their labours about mid-1947. There, apparently for the first time, they learned of the US T 65 cartridge (cal. 7.62 x 51 mm), which is today's standard NATO ammunition, and of the T 25 rifle.

The T 25 was a gas-operated rifle which was in many respects similar to the BAR and GARAND rifles. It was equipped with a straight-line stock and high sights. However, it was very tiring to fire this weapon, it often jammed, and the military experts were not pleased with it at the time. But, on the other hand, the T 65 cartridge was already very popular and its performance widely recognized.

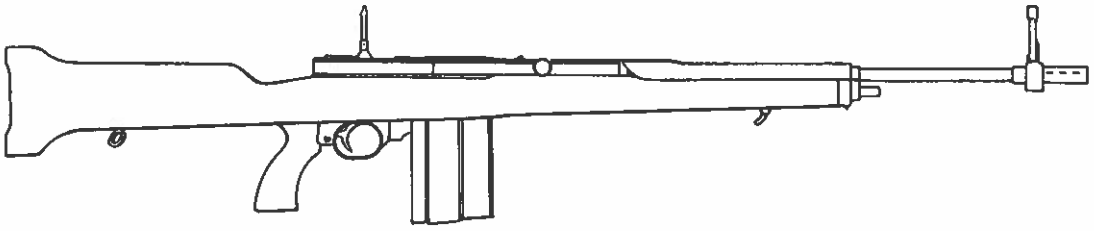
The English presented their .280 (7 x 43.5) cartridge and were told in no uncertain terms how unsuitable it was. On their way back to England they were still not convinced that their brainchild was as bad as the Americans made it out to be. Spurred on by American criticism, unjust for such an excellent cartridge, the islanders set about developing a rifle that would meet present-day requirements. So from then on the Americans were faced with tough competition. Still, they were determined that Uncle Sam would conquer the western arms market.

In the meantime FN, in Belgium, were no longer satisfied with the SAIVE, and they wanted to catch the boat before it was too late. The Belgians remodelled the SAIVE to turn it into an assault rifle, first using the German Sturmgewehr 44 cartridge, then the English .280 or 7 mm FN.

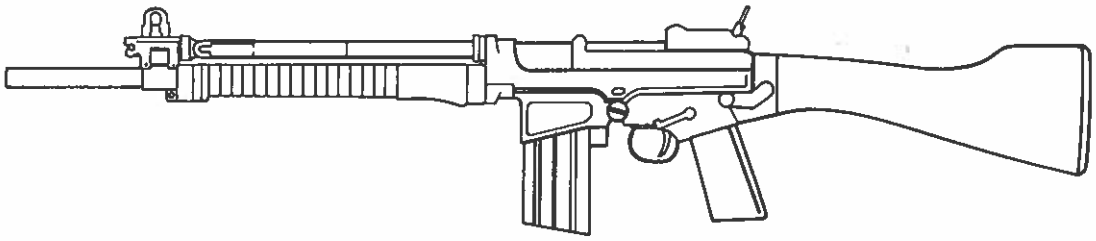
The French, after a series of bitter set-backs, designed the semi-automatic MAS 49 for the 7.5 x 54 mm (M 1929 C) cartridge. This rifle was superseded by Mod. 49/56.

In 1950 the real struggle within NATO began, when its members decided to adopt a uniform infantry weapon.

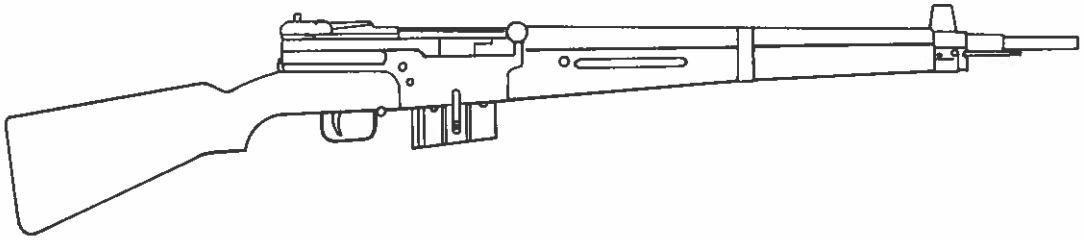
In the USA, the English and Americans subjected their respective rifles and cartridges to field tests. The opponents, the American T 25 rifle/T 65 cartridge and the English EM-



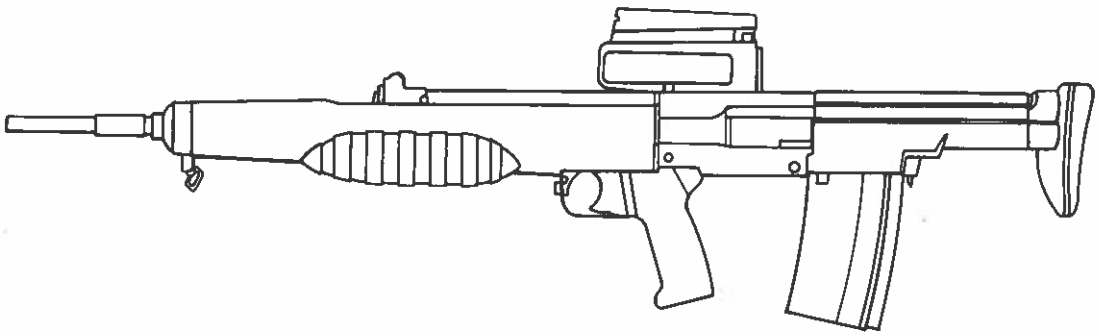
US T-25 rifle (7.62 x 51 mm)



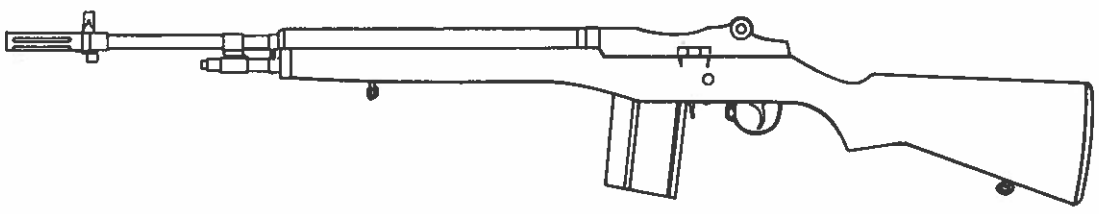
FN-SAIVE assault rifle (7 mm or .280)



French semi-automatic MAS Mod. 49 (7.5 x 54 mm)



English EM-2 (.280)



US T-44 rifle (7.62 x 51 mm)

2 Rifle/.280 cartridge, now had to fight it out between themselves. The EM-2 was unconventional in appearance and packed with new ideas. Overall length was 890 mm, barrel length about 600 mm. This was achieved by placing the breech mechanism and the recoil spring in the butt(cf. the US bull pup rifles). The 20-round magazine was situated behind the pistol grip. After testing, the Americans considered their T 65 cartridge the better of the two contestants. It was equal to the Russian 7.62 x 39 mm. The Americans were unimpressed by the .280's superior ballistics over long distances. Despite American opposition the English expressed their intention to adopt their own design.

Thereupon, the English once again returned home and publicly demonstrated the EM-2, a prototype of a medium machine gun, and the .280 cartridge at Warminster in August, 1951.

The Belgians then demonstrated their new SAIVE assault rifle with its improved 7 mm cartridge, in September, 1951. So now the .280 or 7 mm FN could not be easily pushed aside. The experts in America and Canada were undecided among themselves as to which which of the two cartridges they should give preference.

In the winter of 1951 the Americans publicly demonstrated their newly designed assault rifles. This was the T 47, an improvement over the T 25 and the T 44, which turned out to be

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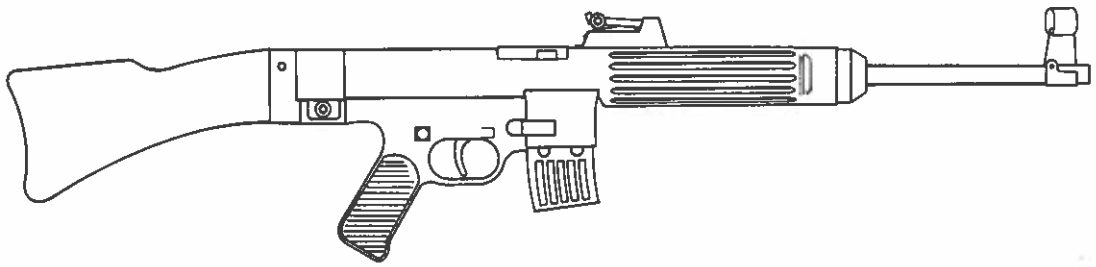
a modernized Garand for selective fire, possessing a 20-round magazine and a muzzle brake. Moreover, they also put on display the T 20; a standard M 1 Garand; a converted M 1 Garand for the new T 65 cartridge and a new heavy-barrelled rifle, the T 22.

Between 1952/53 developmental work continued, but the Americans soon became aware of the fact that they had suffered a loss of prestige in the assault rifle sector. Regrettably, that beautiful little weapon the English had conceived was doomed from the very start. It was born under the aegis of Emanuel Shinwell, a Labourite who was Britain's Defence Minister at the time, and was of a revolutionary design in a country steeped in tradition.

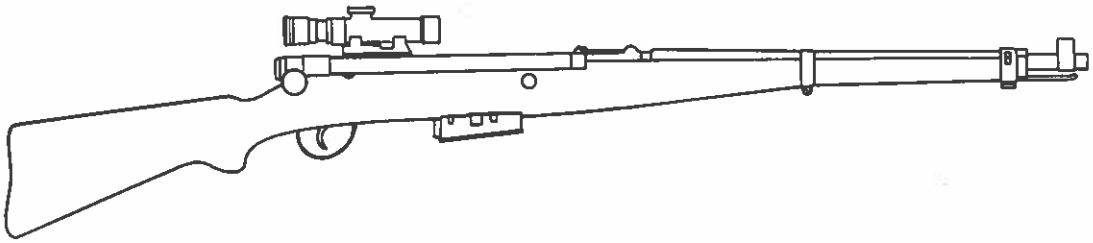
When the Conservatives came in they did not want anything to do with it. But other countries had not been idle. In 1953 SIG of Switzerland introduced their AK 53. The Swiss had applied new and interesting methods in gun designing. It was gas-operated and, externally, looked just like other assault rifles; but the breech mechanism and its function was exactly the reverse of conventional gas-operated weapons.

This rifle is interesting enough to warrant a short description. When the cartridge is fired gases propel the bullet at high speed down the barrel in the normal way, but just before the bullet leaves the muzzle a part of the gas is bled off through a small hole drilled in the side of the barrel and enters a gas cylinder where, in turn, it drives back the operating piston. When this piston reaches its rearmost position, it engages a so-called actuator tube. The compressed spring of the piston now expands, the piston moves forward to its original position, taking with it the actuator tube. During its forward stroke, the actuator unlocks the barrel from the breech and moves it forward, too. The hull (empty cartridge case) remains held in the claws of the breech and is thrown out by the ejector, which is activated by a sliding member, when the barrel is in its forward position. The sliding member disconnects the trigger mechanism when the barrel is fully forward. A fresh cartridge is fed into the claws of the breech, in alignment with the bore. In the meantime the actuator tube, which had been transported to the front by the barrel, is released from the piston. The return spring now expands, forcing the barrel back into its normal position to chamber the next cartridge.

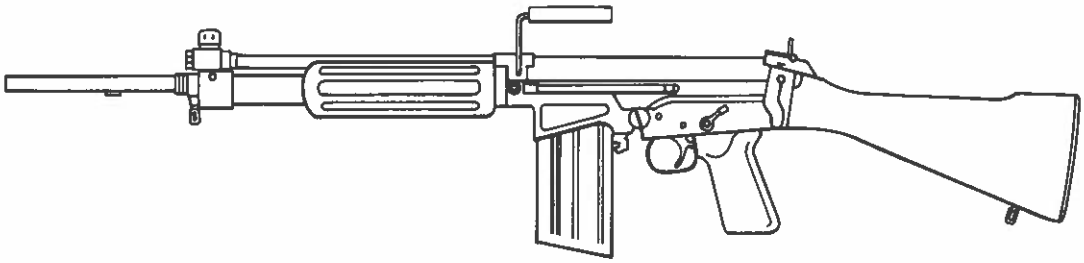
When the barrel is in contact with the breech it is locked there by the actuator. The sliding member



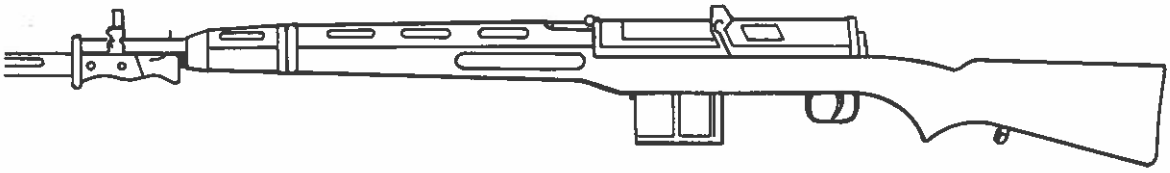
Sturmgewehr 45/Gerät 06H (7.92 x 33 mm)



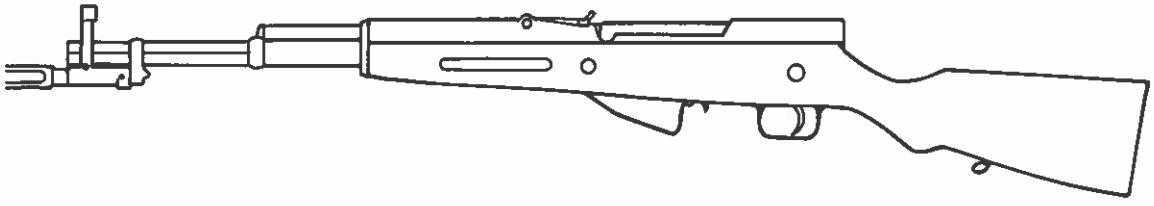
Semi-automatic carbine SK-46 (7.5 mm, Mod. 11)



FN-SAIVE



Ljungman Mod. 49 (.30–06)



Semi-automatic SKS-46 (7.62 x 39 mm)

cocks the firing pin ready for the next shot. The unique thing about this design is that the barrel moves forward away from the breech, not the breech away from the barrel. This holds the rate of automatic fire down to approx. 300 shots a minute.

In December, 1953, the five most important NATO partners met and decided to introduce the T 65 as the NATO cartridge (7.62 x 51 mm), a move that had been long expected.

In the interim the Belgians had converted their SAIVE to fire the newly accepted NATO cartridge. Whereupon, England, much to NATO's surprise, declared in January, 1957, that she would forgo adopting her EM-2, fall into step with the other members and issue her troops with the Belgian NATO assault rifle. Besides, Canada and Australia had also accepted the Belgian weapon. This was a bitter blow for the Americans. Under such pressure, the Americans – at least to save face – were forced to field trial the FN rifle. The appellation given it in the States was the T 48. The outcome was that the Americans adopted their own T 44 rifle, known today as the M 14.

While the Americans were putting the FN to further trials, other contestants appeared on the scene. The Spanish presented their CETME rifle and the Swiss their AM 55 by SIG.

Both the CETME and the AM 55 were national interpretations of the German retarded, roller-locked breech block of Mauser's Gerät 06H or Sturmgewehr 45. Briefly, this hesitation-type locking system uses a pair of rollers placed in the firing-pin assembly either side of the bolthead, which engage in recesses with a 40 degree exit slope in the side of the receiver (breechring).

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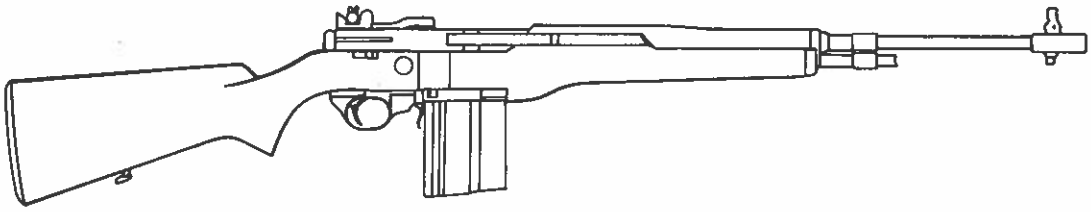
The functioning is so timed that the rollers cannot completely escape from their recesses, to release and open the breech, before the bullet has left the barrel. This system works perfectly even with non-lubricated ammunition. This safety margin is due to the powder gas grooves in the chamber. The Spanish adopted the CETME and the Swiss adopted their SIG-AM 55 under the name of Sturmgewehr 57.

But yet another candidate entered the race which drew a lot of attention to itself, i. e. the AR-10 – the modern lightweight combat rifle, designed by George Sullivan and developed by the Fairchild Airplane and Engine Co. Only the barrel, breech and trigger mechanism are of steel, all other parts being of aluminium and plastics. The AR-10 is gas-operated, but is designed around a new Type of breech lock system.

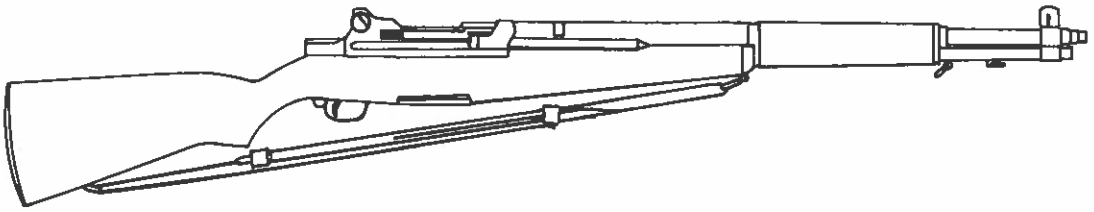
This weapon was also tested in the USA and apparently placed on the short-list before the announcement that the T 44 E 4 and T 44 E 5 were to be adopted as the M 14 rifle and M 15 rifle. The difference between these two is that the M 15 has a heavier barrel and is equipped with a bipod, which bestows on it a light MG character. Despite numerous tests with other contestants, in the USA there was little doubt that the Americans would adopt an all-American version. If the adoption of their own T 65 cartridge was already cut and dried, this was a good argument for developing their M 14 instead of adopting the FN rifle which had become standard in the other NATO countries.

However, it did not take long for the Americans to realize how unfortunate their decision was! The M 14 was soon replaced by the M 16 (.223), a modernized version of the AR 10. Germany also adopted the FN assault rifle, but after 1957/58 it was replaced by the Sturmgewehr G 3.

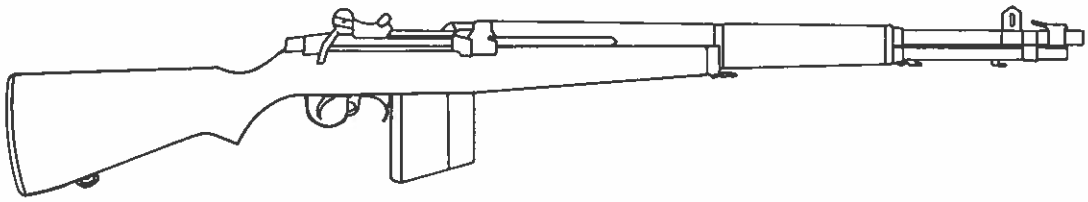
The G 3 is an adaptation of the Spanish CETME rifle, having the indentical breech mechanism. When the Germans found that the CETME did not meet with all their requirements, the firm of Heckler & Koch, Oberndorf, was commissioned by the Federal Defence Ministry to redesign the weapon where necessary and produce an absolutely reliable firearm. That this feat was accomplished is proved by the existence of



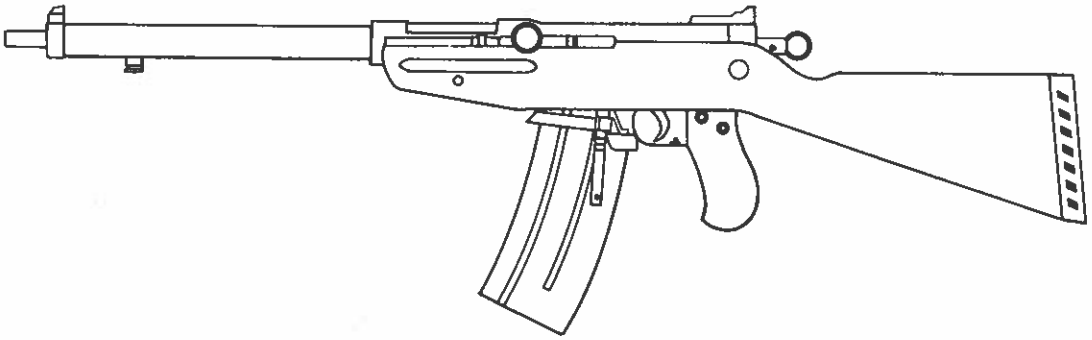
US T-47 rifle (7.62 x 51 mm)



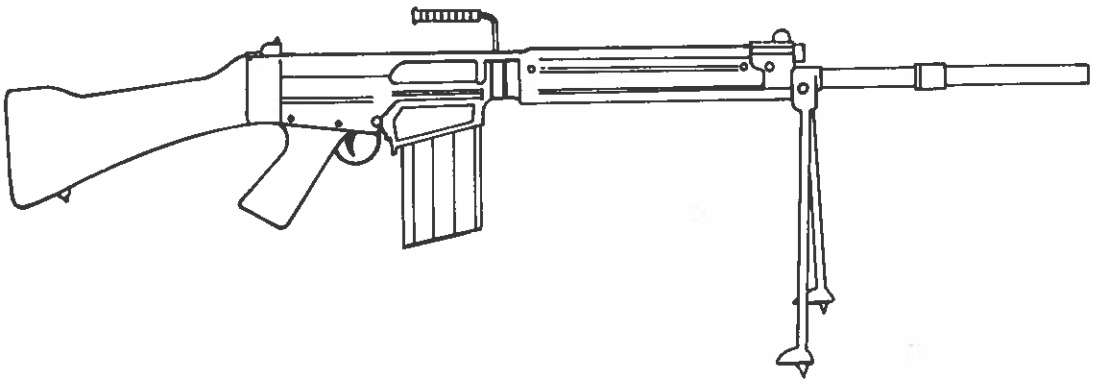
US Garand M1 (.30)



US T-22 E2 (7.62 x 51 mm)



Swiss Automat-Karabiner, Mod. AK 53 (7.5 mm, Mod. 11)



FN-FAL NATO assault rifle (7.62 x 51 mm)

the G 3 in today's Bundeswehr. So, after a tremendous tug-of-war, the NATO members are now armed with 3 different assault rifles: the M 16 A1, the FN-FAL and the G 3.

What is the situation on the other side of the one-time Iron Curtain? At the beginning it was mentioned that the Russians had by 1946 developed a short cartridge and their semi-automatic SKS (Simonov) rifle. This very light and manageable weapon of course had to be debugged like any other new contruction. But in time teething troubles were remedied and it was officially adopted. It is gas-operated and functions on the rising-block principle. The clip-fed magazine (10 rounds) is part of the rifle and a folding bayonet is pivoted under the muzzle. The SKS weighs 3.8 kg.

Czechoslovakia, about 1949, developed the ZK 420, designed for the 7.92 x 57 mm. Externally, it bears resemblance with the American M 14 which, however, appeared later but it was not successful. In 1952 the Czechs gave birth to a new semi-automatic rifle, the M 52.

This weapon was exported in large numbers to the Near East, especially to Syria. The Czechs provided the M 52 with their new 7.62 x 45 mm cartridge which, with regard to velocity and energy has a little more sting than the Russian 7.62 x 39 mm cartridge.

In 1954 the Russians raised the veil of secrecy! They triumphfully showed

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the world that they had outsmarted all by demonstrating the AK 54 Kalashnikov, a gas-operated assault rifle with a rotating bolt. Their military experts had grasped what the Nazis had envisaged for the Sturmgewehr 44 and had drawn the right conclusions. The Russians did not shrink from re-equipping their infantry from A to Z based on experience gained during the last war. Today the Russian infantry is equipped with the AK 54 Kalashnikov and the 1. MG Mod. RPD (machine gun). Both weapons fire the short cartridge. The heavier 7.62 x 54 mm is only fired in their machine gun. The advantages of this set-up are, after many years, clear to all military experts. The AK-54 weighs 3.4 kg, about that of a sub-machine gun. The shortness of the Russian weapon, and its manageableness, gives the soldier freedom of motion while the lightness of the short cartridge, compared to the 7.62 x 54 mm, enables the fighting man to carry nearly twice as much ammunition for the same weight.

Czechoslovakia was the next nation to follow step. The Czechs came forward with their M 58, chambered for the 7.62x45 mm of their 52 model. This is likewise gas-operated, looks very much like the Russian AK-54, but the breech functions on the rising-block principle.

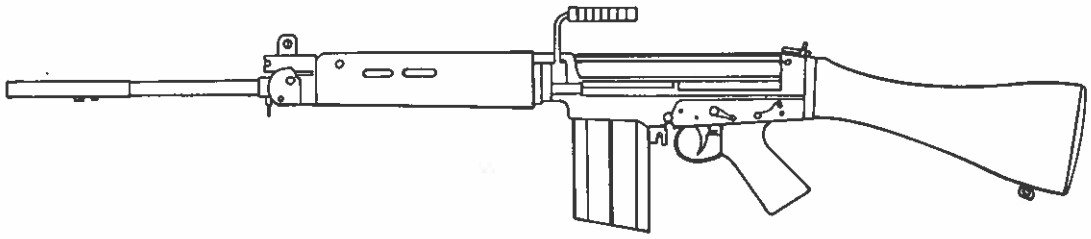
Epilogue

When looking back over the development of modern infantry weapons and making a comparision between East and West, one cannot help but applaud Russian strategy. They have made good use of the last 20 years. The entire East Bloc, including mainland China, is equipped with the AK 54 Kalashnikov. In addition to this, a specified number of soldiers in each company is armed with the semi-automatic SKS. This means that training is identical throughout the East Bloc.

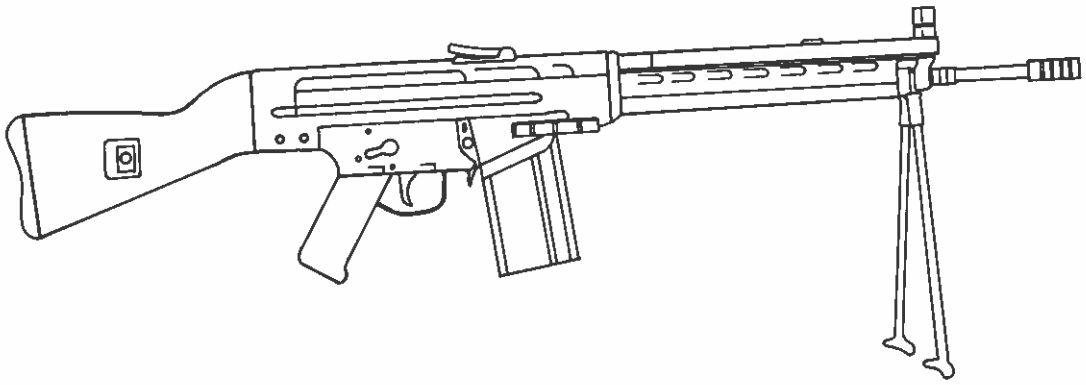
Irrespective of the geographical position, if a war breaks out the Russians and their allies will experience no difficulties at all in obtaining parts or replacements.

And what is the NATO situation? The table on page 164 speaks a language understood by everyone.

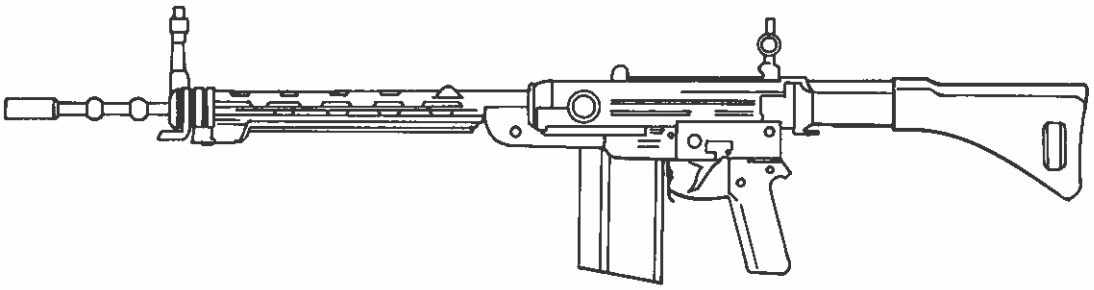
The Russians and their allies have been uniformly armed for about 20 years now, and, although the West has thoroughly tested their 7.62 x 39 mm cartridge, finding it to be good,



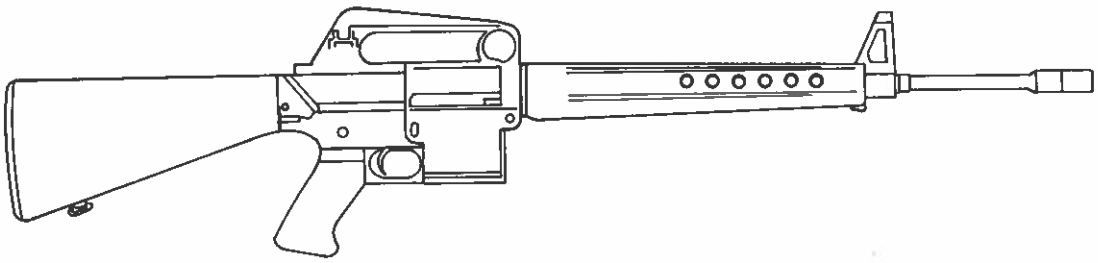
Canadian FN, the FN-C1



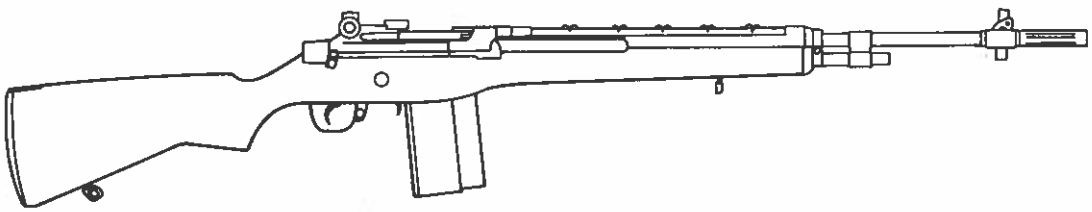
Spanish CETME Mod. 58 (7.62 x 51 mm)



Swiss Sturmgewehr 57 (7.5 mm, Mod. 11)



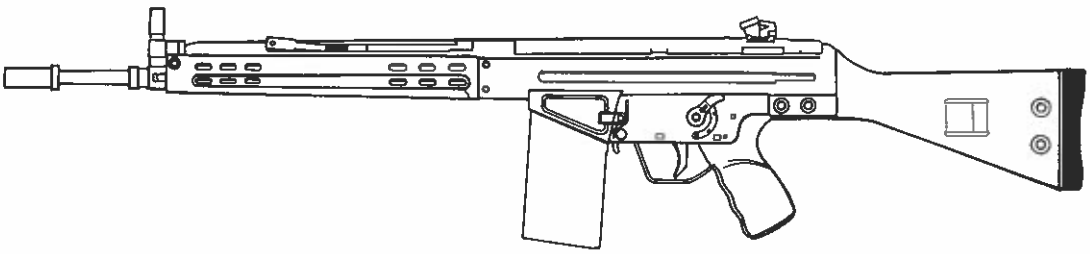
US AR-10 (7.62 x 51 mm)



US M 14 (7.62 x 51 mm)

Assault Rifle

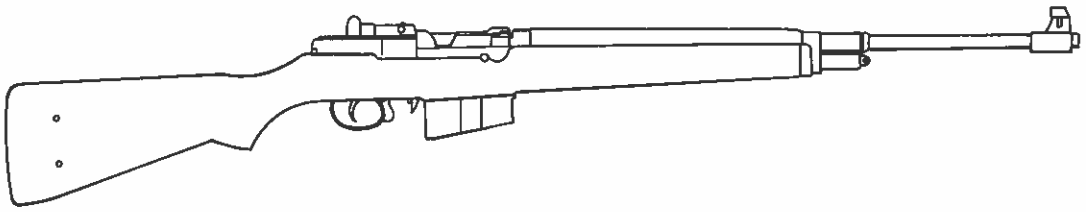
we still hold fast to our more powerful NATO cartridge. Cartridge performance and weaponry design hang together. The stronger the cartridge, the more the weapon has to weigh. The military experts also fail to agree among themselves as to which is the best type of rifle. For to a certain extent the design of a rifle depends on the theatre of war in which it is going to be used. If there are wide rivers to shoot across or positions in mountain tops to defend, then the soldier needs a weapon providing him with stopping-power at long distances. In other words, the enemy must be put out of action at a far distance. The other school of thought – the German tactic during the last war – is to let one's foe come forward to about 50 – 60 m and then blast away for all one is worth. At such short distances every aimed shot finds its mark and the 44 Sturmgewehr cartridge sufficed. Sniping at long distances is best left to the qualified marksman with his special equipment. On the other hand, a machine gun can also be used over long distances. Still, the soldier of today, irrespective of the ideology he is fighting for, is trained for single combat. Gone are the days when soldiers advanced on the battlefield in formation! If it does come to a war between West and East we shall find out soon enough whose infantry is the better equipped. Regrettably, as always, it will be the little soldier of the front who will foot this bill . . .



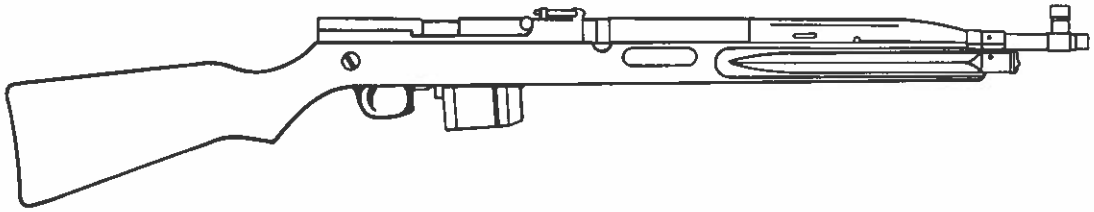
German Sturmgewehr G 3 (7.62 x 51 mm)

RIFLES OF THE NATO STATES

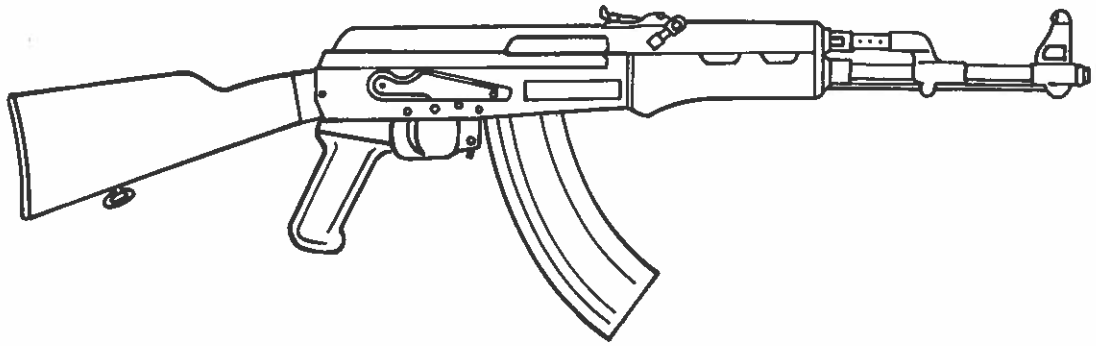
	MODEL	CALIBRE
Belgium	FN-FAL	7.62 mm NATO
Denmark	G3	7.62 mm NATO
Germany	G3	7.62 mm NATO
Britain	FN LI A1	7.62 mm NATO
France	MAS-Mod. 49/56	7.5 x 54 mm, Mod. 1929
Greece	US Garand/FN-FAL	.30-06 and 7.62 mm NATO
Italy	BM 59 (Garand version)	7.62 mm NATO
Canada	FN – C1	7.62 mm NATO
Luxembourg	FN-FAL	7.62 mm NATO
Holland	FN-FAL	7.62 mm NATO
Norway	G3	7.62 mm NATO
Portugal	G3	7.62 mm NATO
Turkey	US Garand	.30-06/7.62 mm NATO
USA	M16	.223



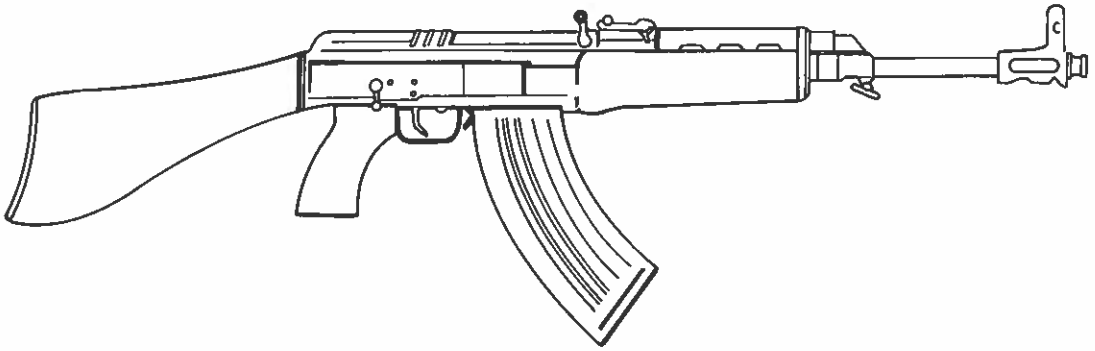
Czech semi-automatic, Mod. ZK-420 (7.92 x 57 mm)



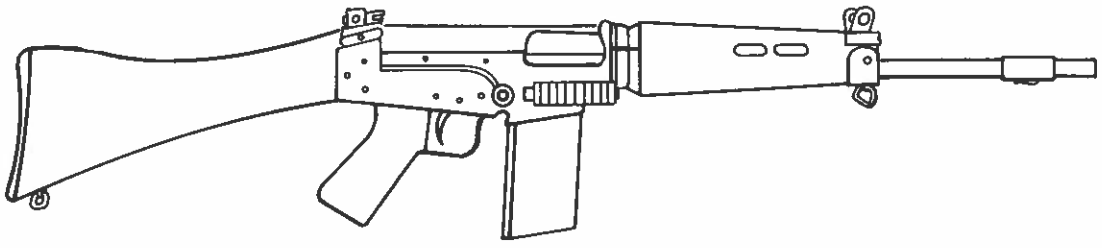
Czech semi-automatic M 52 (7.62 x 45 mm)



Russian AK 54 Kalashnikov (7.62 x 39 mm)

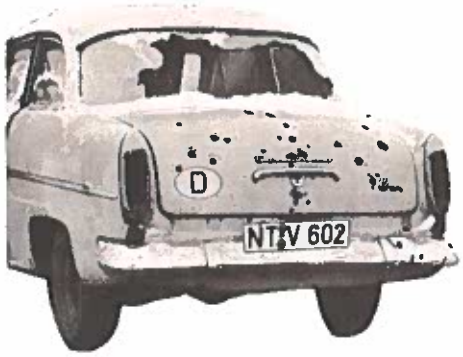


Czech M 58 (7.62 x 45 mm)



English L1 A1 (7.62 x 51 mm), adaption of the FN-FAL

CAN PISTOLS



STOP CARS?

TEXT AND PHOTOS: SIEGFRIED F. HÜBNER

In collaboration with the "Kriminalpolizei" tests were conducted in West Germany to determine the best weapons and ammunition for blasting the get-away cars of escaping criminals.

Let me say in advance: When aiming at the rear tyres the only sure way of stopping a vehicle is to release a few bursts from a sub-machine gun, calibre 9 mm Luger! Ten rounds being the minimum when forced to fire diagonally through the fenders, as a number of the shots will be deflected. If the get-away car is fitted with tubeless tyres, only a round through the rim will stop him quickly. Only the 9 mm Luger has real penetrating power. It is true that the 7.65s go through the tread and that the air of a tubeless tyre will escape after two or three miles, but they lack potency to slam through the rim.

How we went about it

We had a 1960 Ford 12 M jacked up at the back far enough to look the wheels in the face. Then we switched the motor on and rigged the accelerator to spin the wheels at 60 mph. Having set the scene we repaired to our positions and blazed away at 7 different types of tyre with various hardware. Air pressure was measured before and 3 minutes after each test.

The pistols we used: PPK, cal. 7.65; Mauser Broomhandle, cal. 7.63; .45 ACP Colt; P 38, cal. 9 mm Luger; Combat Magnum, cal. 38 spec. and .357 Magnum; .44 Magnum Liberty. For the sake of comparison we also took along a 9 mm (Luger) Beretta submachine gun.

All shots, irrespective of the calibre (.22 l.r., HV or 7.65, etc.), were fired at a distance just over 6 yards. Tubed tyres blew out in every case, after a few hundred yards they flattened out like a pancake and fell from their rims. Funnily enough, no matter where we punctured the tyres the whine of escaping air always sounded as though it came from the valve. (Radial ply tyres with tubes were also tested). Figure 2 shows a 7.65 entrance shot in a tubed tyre.

Tubeless tyres are more difficult to deflate if you are not swinging the right gun. The speed of the tyre hardly influences the initial punch-through. Figure 2 is a good illustration of

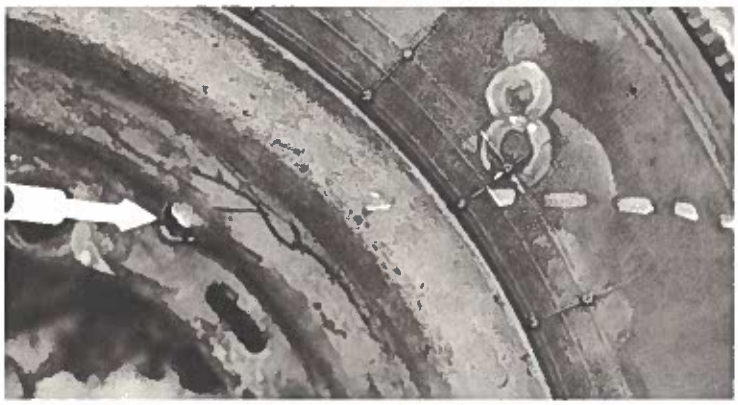
Beretta 38/49 sub-machine gun

1

1 *Test were conducted with these weapons.*

2 *7.65 mm entrance shot.*

3



4

2

5 a

5 b

6

3 *9 mm Luger through the rim.*

4 *Getting at the tyre through the bodywork.*

5 a *and* **5 b** *Entrance shots in the boot.*

6 *Pressboard punctured by 9 mm Luger, .45 ACP, .357 Mag. and .44 Mag.*

CAN PISTOLS STOP CARS?

this, since the hole was made by the 7.65 PPK. If the rim was not punctured — as was the case when using .22 HV, .7.65, .45 ACP and, very rarely, the 9 mm Luger — the tyre still had 11.8 psi after 3 minutes, instead of 26.4 psi. In other words, the tyre has only lost about fifty per cent of its initial pressure and the bandit could go on for another 2 or 3 miles.

It was a different picture, however, when firing through the rim with a .357 Magnum (metal piercing) or with the 9 mm Luger: the tyre emptied immediately (Fig. 3). As mentioned, it is sometimes necessary to fire through the bodywork to reach the tyre. Our submachine gun tests proved that only two from a burst of ten shots actually reached the tyre, the others were deflected by the bodywork. (Fig. 4).

Firing into the car from the rear

We inserted a pressboard, 2 cm thick, in the driver's seat. The 7.65 PPK got stuck in the back of the seat, also .22 and .38 spec. bullets. As seen in Fig. 6 the best calibres for smashing through this type of armour are the 9 mm Luger, .45 ACP, .44 Magnum. The .357 Magnum (metal piercing) zinged right through our jalopy and did not stop until it reached the radiator. But the real surprise was the .45 ACP's terrific gnawing power (Fig. 6). We then gave a burst of about 30 shots with the Beretta. The 9 mm Luger bullets ripped through just about everything, making mince meat of the dashboard and electrical parts. They landed up in the engine. Gangsters just would not have had a chance . . .

Trying the doors for strength

We righted the pressboard and resumed our positions. This time we fired through the doors, the entrance shots can be seen in Fig. 9, the exit shots in Fig. 10. The 9 mm Luger, 7.63, .45 ACP and .375 Magnum

7

8

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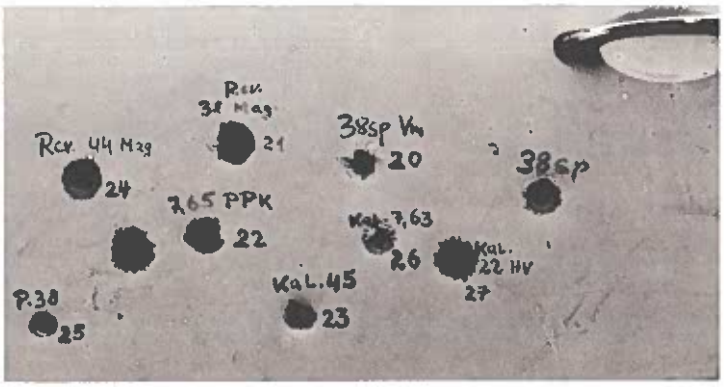


7 *Letting the Beretta speak for itself . . .*

8 *The outcome.*

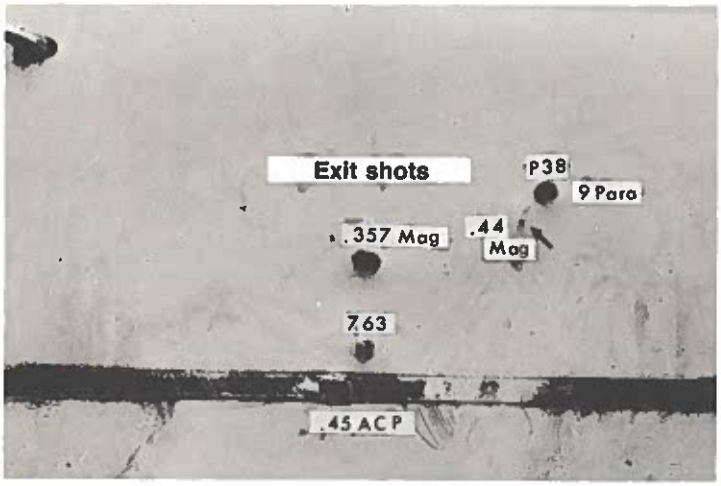
9 *Entrance shots in the door.*

sailed through both doors, but the .44 Magnum (semi-jacketed) got stuck in the second door. The .22 HV, 7.65 and .38 spec. shared the same fate. The .38 spec. (lead) did not even reach the pressboard. We also have news for shotgun addicts, too. These scatter guns certainly made a spectacular mess-up of the car, but the pressboard was hardly scathed.

Entrance and exit shots

In order to find out what happens to a bullet after it has penetrated a door of a car, we placed a crate full of 2 cm plywood sheets on the driver's seat of a Fiat 500. This time we fired from 2 yards. Lead bullets immediately deformed, causing deep dents before punching through. On the other hand, the full-jacketed bullets stamped out little cups that were recovered in the crate (Fig.12, lying before the 9 mm and 7.65 bullets). These cups might well be of interest to the crime lab; for they will either be found in the delinquent's body or in his clothing. Microscopic probes would reveal the type of car, etc. Table 3 shows the depth of penetration in plywood after the bullet has passed through the door of a car. Fig. 10 shows the exit shots through the second door. It is interesting that the full-jacketed bullets still stamp out nice round holes after passing through two doors and a crate of wood. The jagged holes are those from the lead bullets. All calibres will go through the doors, the exit hole telling whether it was a lead or full-jacketed bullet. In Fig. 12 it can be seen that the noses of the full-jacketed bullets become slightly flattened, whereas those of the lead bullets mushroom out. At the same time we established that all calibres will easily cut through safety glass.

10



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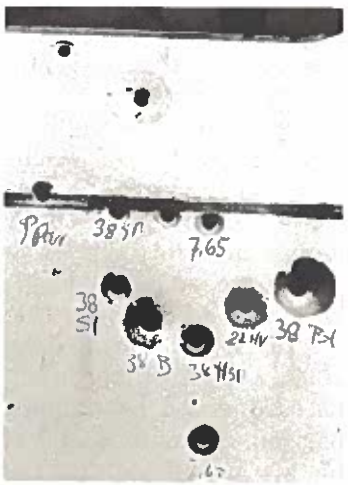

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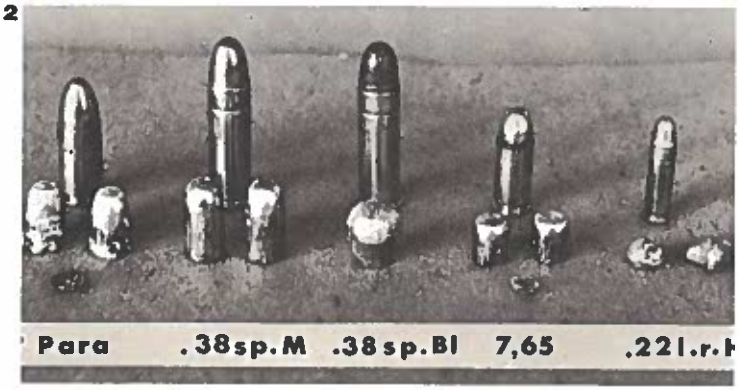


10
Exit shots through the second door.

11
Lead and full-jacketed bullets, entrance shots.

12
Before and after (note the metal cups).

CAN PISTOLS STOP CARS?

Hammering at Plexiglass

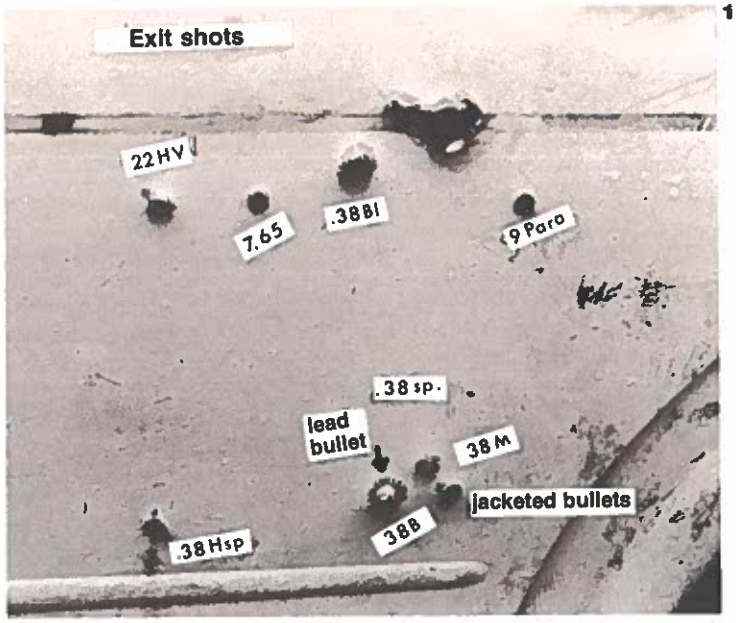
We then set up a three-layer, 40 mm sheet of Plexiglass at 4 yards (kindly provided by Röhm & Hass) and soon found out how strong it was.

Fig. 14 shows that the .22 HV, 7.65 and .38 spec. did not even get through the first layer, the 7.63, 9 mm Luger and .45 ACP faired little better. Even the .357 Magnum (metal piercing) could not penetrate this plastic.

Relative stopping power

Mr Hatcher, an American, has worked out a formula for arriving at the stopping power of a specific cartridge when used on human beings. He modifies thrust, a product of weight and velocity, with the projectile's diameter, shape and material (relative power transmission capability). To get the rsp value the result is multiplied by 1000, a figure that should be used as a basis of comparison. By looking at Table 2 you will see that the .45 ACP has twice as much relative stopping power as the 9 mm Luger (60:30 rsp), but cannot compete in penetration (6:11 boards). It is also interesting to note that the .44 Magnum has five times more recoil than the .38 spec. However, if you want to shoot with one of these giants (160 rsp and 13 20mm boards) you will have to be in physically

13



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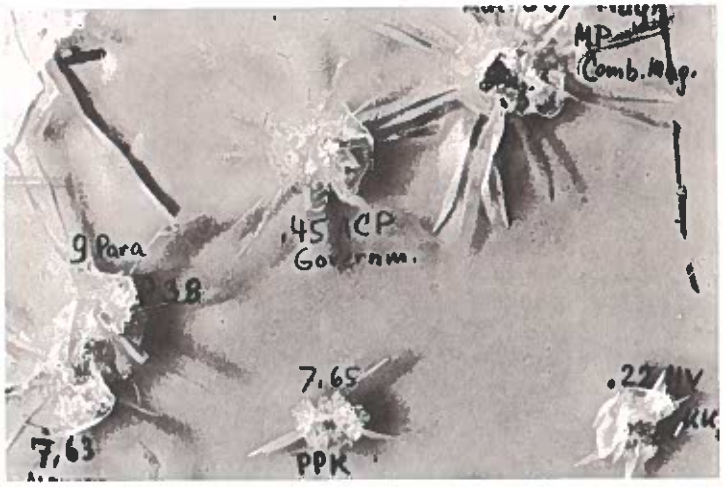


15

13
Lead and full-jacketed bullets, exit shots.

14
Plexiglass.

15
9 mm Luger bullets with high stopping power.

1

Ammo	Weapon	Penetration into plywood after zipping through a car door (Fiat 500)
.22 l.r. HV	PP	**1 cm**
7.65 mm	PPK	**5 cm**
.38 spec. lead	Comb. Ma.	**2 cm**
.38 spec. full-jacketed	Comb. Ma.	**5 cm**
9 mm Para	P 38	**15 cm**

2

Hatcher's relative stopping power
9 mm Luger / 9 mm short / .38 spec.

.22 l.r. normal	**3,3 rsp**	.38 spec. Keith .38	**49.2 rsp**
6.35 mm	**3.7 rsp**	Super Auto .38	**31.8 rsp**
7.65 mm	**10.0 rsp**	.357 Magn. 3.5″-bbl.	**53.3 rsp**
9 short	**13.2 rsp**	.45 ACP Auto Gov.	**60.0 rsp**
7.63 Mauser	**16.8 rsp**	.45 ACP Super X	**70.0 rsp**
9 mm Para	**29.4 rsp**	.45 Colt Peacm.	**76.3 rsp**
.38 spec. standard	**30.8 rsp**	.44 Magn. 6″-bbl.	**160.0 rsp**
.38 spec. sup. police	**36.3 rsp**		

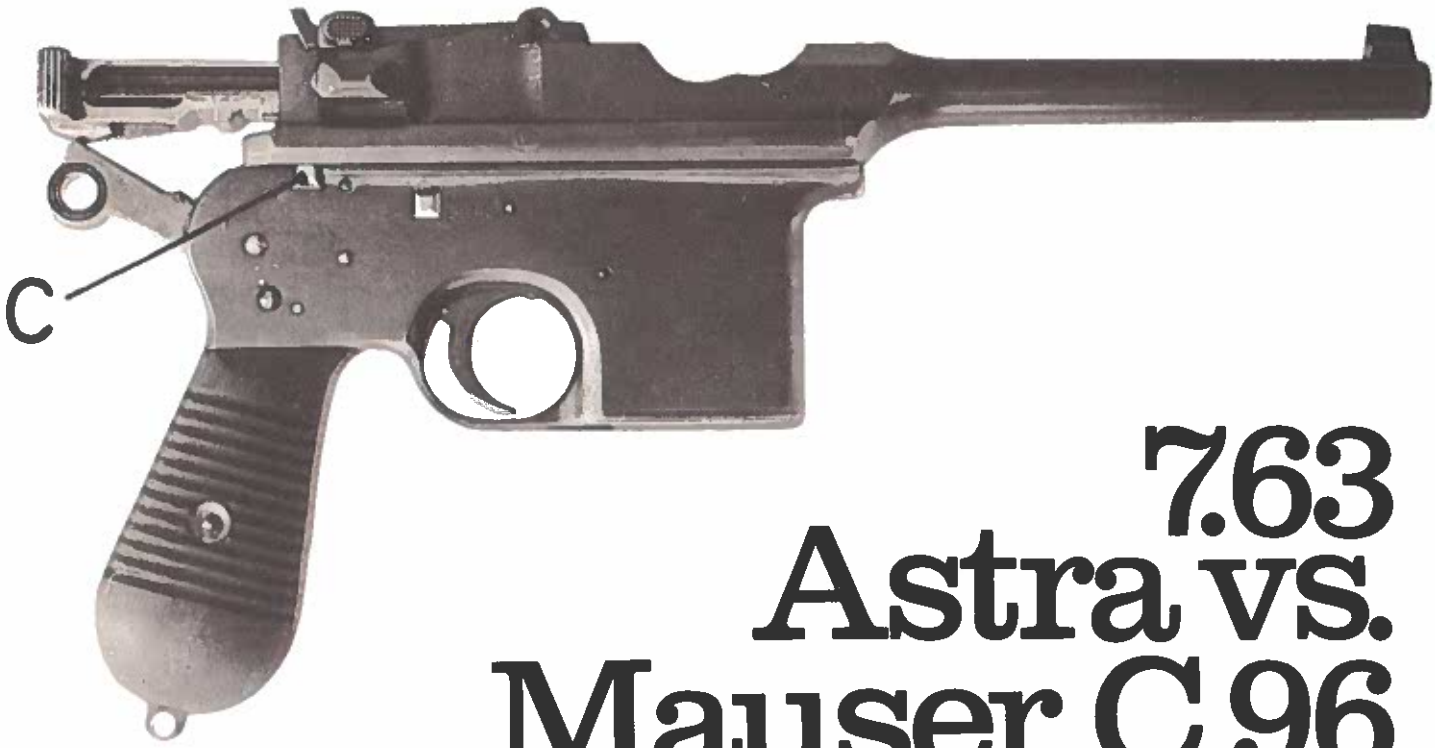
3

Ammo	Relative stopping power	Penetration into pine wood
.357 Magnum	67.9 rsp	12 boards (each 2 cm thick)
.45 ACP Super X	70.1 rsp	11 boards
.44 Magnum	160.0 rsp	13 boards
These cartridges provide good stopping power and good penetration.		
9 mm Para	29.4 rsp	11 boards (each 2 cm thick)
Super .38	31.8 rsp	11 boards
.38 spec. Met. Pier.	35.8 rsp	12 boards
These cartridges provide good penetration, but are somewhat lacking in stopping power.		
.45 ACP Goverm.	60.0 rsp	6 boards (each 2 cm thick)
.44 spec.	60.6 rsp	4 boards (each 2 cm thick)
.45 Colt	76.3 rsp	6 boards (each 2 cm thick)
The cartridges provide good stopping power, but poor penetration.		

good shape to wield it! According to these tables the .38 spec. (standard) has a higher stopping power than the 9 mm Luger. Hatcher says that owing to the coefficient of friction, the .38 spec. lead bullet delivers more energy at the target than does a full-jacketed bullet. Table 3 shows rsp and depth of penetration. Tables 1 and 2 show that 7.65 mm is not a man-stopper and that it also lacks in penetration qualities, whereas the 9 mm Luger has good penetration qualities, but should be fitted with the Norma type semi-jacketed bullet (Fig. 15) to increase stopping power. A different bullet would also add punch to the .38 spec., an increase from 30.8 to 36.3 rsp being envisaged.

Shotguns certainly made a spectacular mess-up of the car, but the pressboard was hardly scathed. Our tests proved how important it is to know the capabilities of each type of cartridge. A police official never knows when he might need this knowledge ...

RSP and Penetration



7.63 Astra vs. Mauser C 96

Every gun collector must surely know of the legendary Mauser 7.63, the C 96 pistol which is commonly called "the broomhandle." It must have been reviewed many times over in all the world's gun journals. Most of the articles have also dealt with, or mentioned, the many imitations of this famous pistol. By imitations I mean identical copies or copies that are virtually identical with the original. This certainly holds true with the Chinese version of the Mauser, whereby in some instances the Mauser inscriptions have also been copied, although incorrectly. On the other hand, there exist imitations that in many respects differ considerably from the original Mauser. INTERNATIONAL ARMS REVIEW compares the C 96 with a distinguished rival.

TEXT AND PHOTOS: E. BRUNNTHALER

The weapons illustrated here were kindly lent to the author by the Bayerisches Armeemuseum.

The best known copies of the Mauser C 96, qualitatively speaking, must be the Spanish Astra models 900 to 903. Externally, the Astra is indeed very similar, but, internally, it has a design of its own. The reason for this new conception of the Mauser is, at best, cloudy. For a product that has been service-proved, irrespective of the industrial sector, is, usually, only subject to copycatting when the infringer is unwilling to invest the high costs of development or is not qualified to conduct such an undertaking, and prefers to rest on other people's laurels. Plagiaries of all descriptions are perpetrated the world over every day; the shadiness of the act seems to do little to discourage it. Of course, here I am not talking about the manufacture of commodities under license as stipulated in accordance with the provisions of an agreement made out between two or more firms, such as is customary in the arms industry, for example. As to why only the outer shell of the Astra resembles the Mauser, while the innards are quite different, is an matter of conjecture; for one can hardly assume that the C 96's success on the market boils down to its external appearance.

Its popularity, especially in Latin America but also in Europe, may be more wisely ascribed to the Mauser's performance and extraordinary rugged-

ness. Yet the Astra's action and locking mechanism are the parts that differ most! However, this does not mean, in this respect, that the Astra is inferior to the Mauser. It is quite likely that Mauser's design constituted a bar to the grant of a patent, compelling the Spaniards to find new ways.

When comparing 4 Mauser and 2 Astra pistols, I discovered that the triggers of the Astras were smoother and crisper than those of the Mausers, but, of course, such a test can only be valid if carried out by comparing several pistols all of the same good condition. A slight disadvantage with the Astra is perhaps its use of a number of loose hinge pins, something the Mauser has avoided. On the other hand, stripping and assembling the Astra is simpler, when one discounts the removing or mounting of the trigger unit.

The 7.63 mm Astra was marketed in 4 main variations for single shot or full automatic, with integral box-type magazine or detachable box for 10 and 20 rounds, as listed in the table. Slight constructional differences or differences in barrel length not being considered.

When comparing the Astra with the Mauser, externally, it will be seen that the forward position of the magazine, the shape of the barrel, the angle of the handle, its stocks, as well as the hammer and the sights, are virtually identical. The slide (actually this is only a bolt housing that is part of the barrel and runs a short distance backwards to unlock) is about 10 mm longer than that of the Mauser.

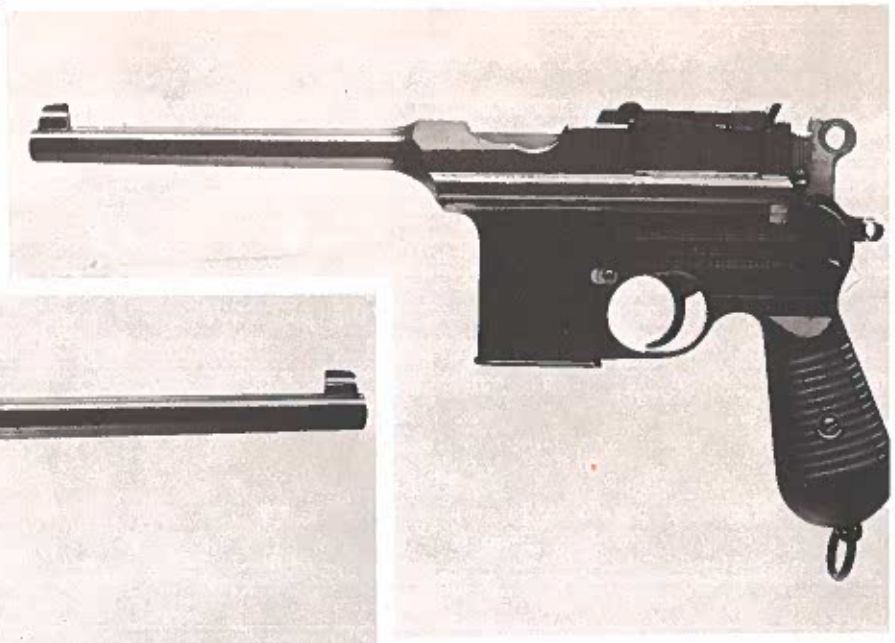
Modell:	**900**	**901**	**902**	**903***
single shot	yes	yes	yes	yes
full automatic	no	yes	yes	–
redarded auto.	no	no	no	yes
built-in mag. for 10 shots	yes	no	no	no
built-in mag. for 20 shots	no	no	yes	no
detachable mag. for 10 and 20 shots	no	yes	no	yes

* Also produced in Cal. 9 mm Bergmann and known as the 903 F.

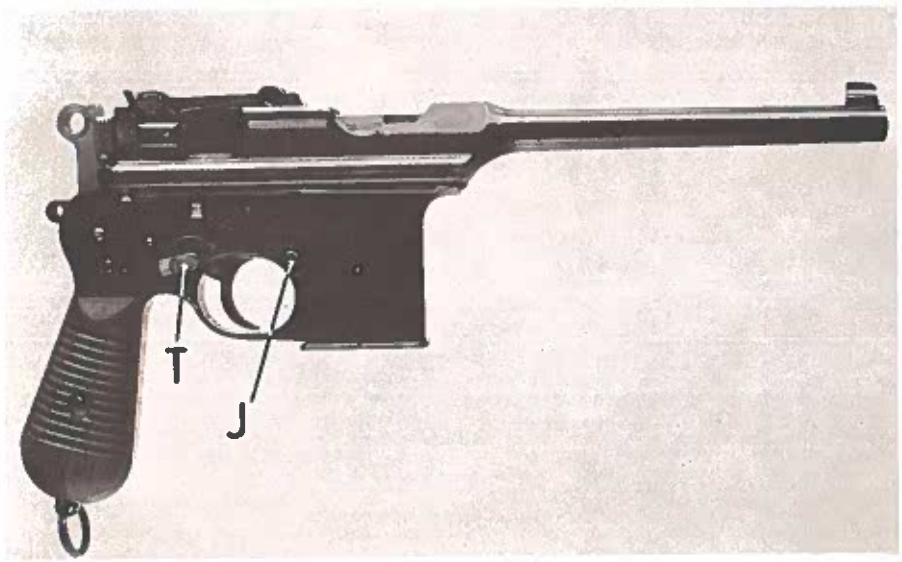
1 *(right)*
Astra model 900 with clip of 10 cartridges and original box of 20 cartridges.

2 *(left)*
Astra model 900 with action open. C = Locking post for cover plate.

4



3
Astra model 901 machine pistol (with 10-shot detachable magazine). J = Magazine catch T = Selective-fire switch



3

4
Left-hand side of Astra Model 901. 20-shot magazines available

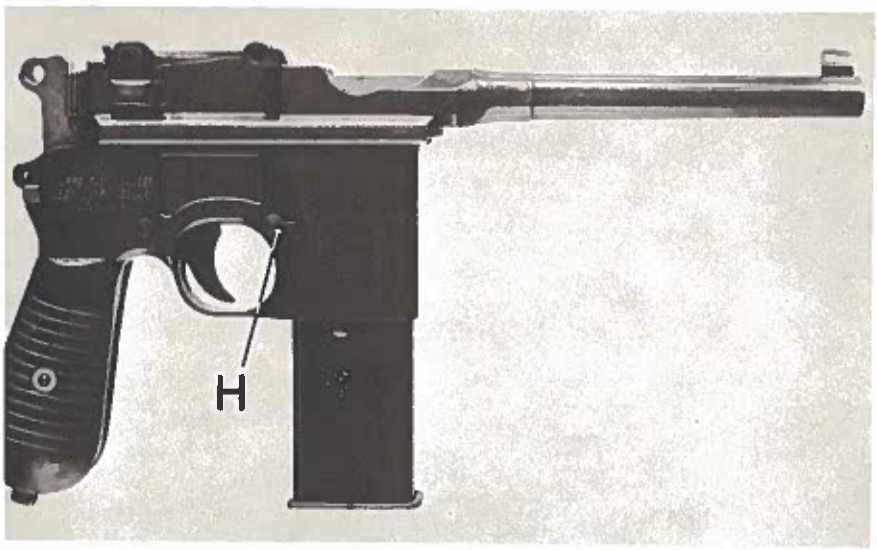
The Astra model 901 that I reviewed had a 22mm longer barrel than its compatriot, model 900. Whether this is always the case, I really cannot say.

The 20-round Mauser and the 10-round Astra magazines are compared in illustration 7. In the case of the Mauser the latch lip of the magazine is situated on the back strip (held by the magazine catch H in ill. 5) and with the Astra the magazine is notched (f) on the lefthand, rear side, held by the magazine catch J in ill. 3. The lateral lip (i) of the 20-round Mauser magazine prevents the magazine from going up too far. This detent is not necessay with the 10-round magazine, as the bottom fits flush with its guide holder.

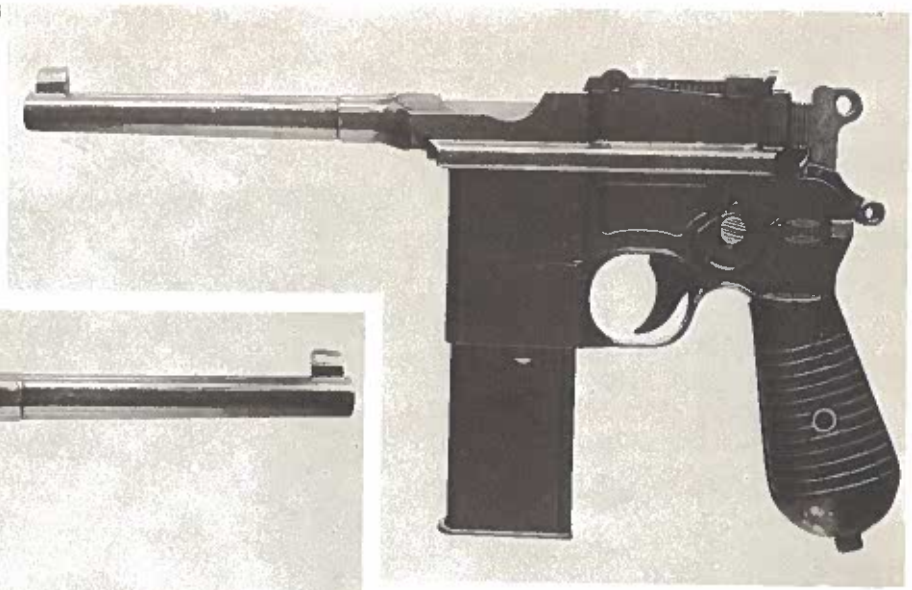
The wooden shoulder-stock holster is basically the same for both weapons. However, slide length, among other things, precludes using one or the other holster for both pistols. See ill. 8.

Illustrations 9 to 12, 15 to 18 and 22 distinctly show the lock mechanism of the Mauser, which includes the hammer, the mainspring, the sear and disconnector and the safety device; whereas with the Astra these parts are mounted separately in the receiver and boxed in by a cover plate, which is dustproof, however.

Illustration 13 compares Mauser and Astra barrel assemblies. The spring B of the Astra is the barrel (slide) recoil spring, which is counterbutted by the stay of the receiver, ill. 9. The Astra locking link A 2, unlike that of the Mauser, A 1, is permanently hinged on pin D in the slide (ill. 12). When the breech is closed, through pressure exerted on the receiver by spring B, the square post E, situated in opening (g), forces the link A2 to ride high and engage the recesses (d) in the lower side of the bolt. The barrel and breech block are now locked together, a system basically similar to that of the Mauser. (see ill. 14). When the bullet starts its journey down the barrel the gas pressure in the chamber is still high enough to blow the barrel and breech block, still locked together, backwards at a very high speed. However, after about the first 6 mm of travel, barrel and breech block separate. This is accomplished in that the link A2 is, in the rearward position, no longer supported by the post E and that the wedge-shaped tail end (b) of the link passes under the deflector bar F (illus. 19). The breech block (or bolt) is now free of the slide, the link



5
Mauser 712 (1932) with 20-shot magazine. H = Magazine catch.



6
Left-hand side of Mauser 712 with selective-fire switch.

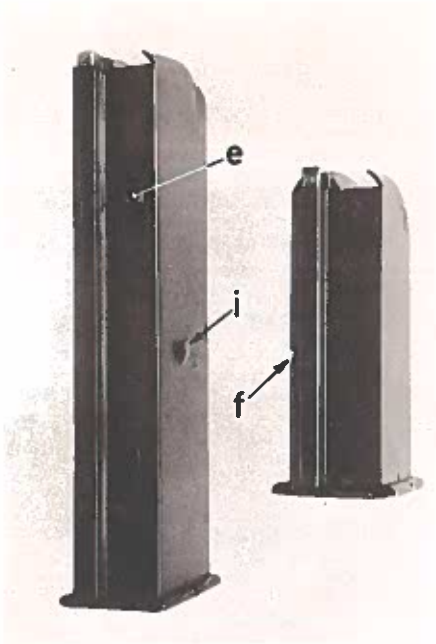
having dropped clear of the recesses (d), and travels on backwards alone, ejecting the empty cartridge case in the normal way. Illustration 14 shows the breech blocks, strikers, hammers and hammer pins, spring retainers, which also limit the distance travelled by the breech block, and the safety catches, of both makes.

The hammer spring of the Astra is housed in the backstrap of the handle frame (illus. 9) and presses, via a small cap, against the hinged finger G (illus. 14); whereas the hammer spring of the Mauser is housed nearly horizontally in the body of the lock frame. The hammer of the Astra is less subject to friction. This spring arrangement is seen in some modern revolvers. In the Astra the trigger, pivoted by pin M (illus. 15), can actuate the sear N via the lug O. When the trigger is pulled the upward movement of sear N forces the pawl P to disengage the hammer. Once the hammer has been cocked again, the hairpin spring O drives the pawl P into the hammer detent.

To prevent two or more shots being fired at one trigger pull, the sear N, via an upright finger (1), is struck down with the link A 2 when the breech block opens, disengaging the base of the sear from pawl P. In this way the pawl, unmolested, can catch the hammer, thrown back by the opening breech block, and hold it in the cocked position. The coil spring U (illus. 15) lifts the sear to engage the pawl, once the breech block has returned to its home position, and the pistol is locked. For the sake of comparison, illustration 16 shows the lock mechanism of a 9mm Mauser (the innards of the 7.63mm and 9mm Mauseres are identical). Here the sear S engages in the hammer detent.

The Astra machine pistols have a selective-fire switch T on the right-hand side of the receiver (illus. 3), which, when on automatic fire, allows more leeway between the upright tongue of the trigger and the sear N.

In the machine-pistol versions, the pawl P (illus. 17 and 18) is fitted with a tailpiece m. When the sear N is forced downwards by the link A2, when the breech opens, the base of the sear is, owing to the pawl's tail piece, still in engagement with the pawl, permitting the hammer to drop immediately every time it has been cocked by the opening breech block. However, the hammer, if unchecked, might fall on the firing pin (housed in the breech block) as fast as, or faster than, the breech block could move forward and lock in the home position. It is possible that the next cartridge would be prematurely fired, i. e. fired before the link has firmly locked the breech. This could cause a very nasty accident indeed. But what is more likely to happen under such circumstances is that the



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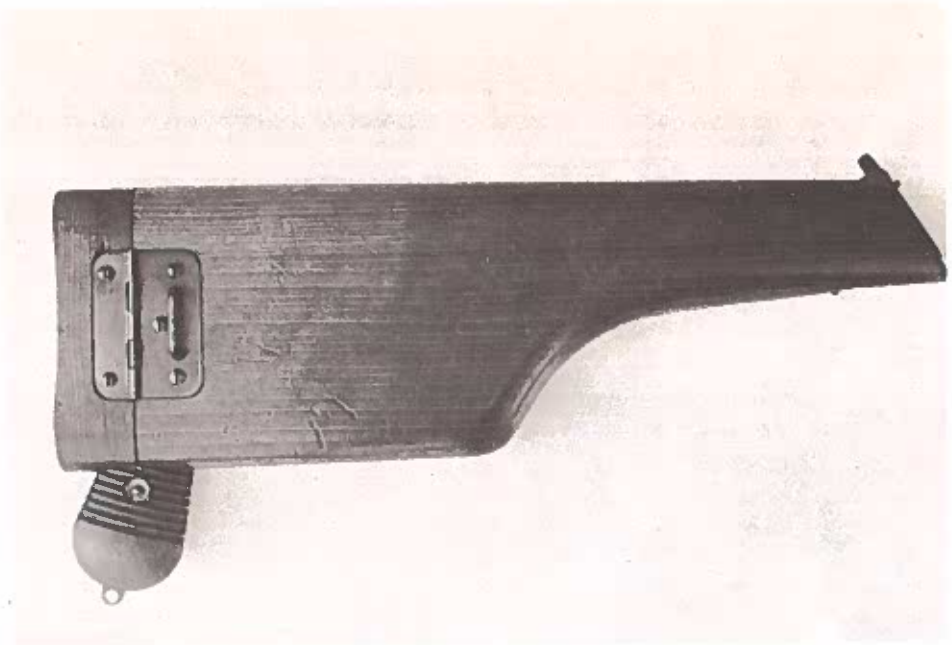

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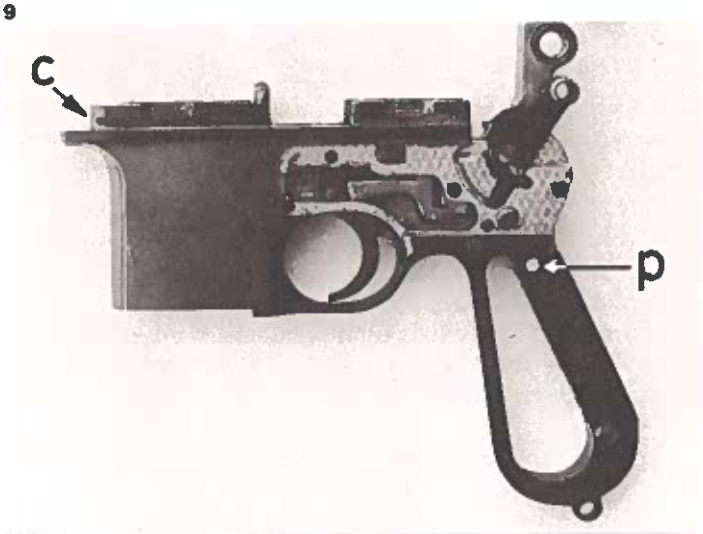

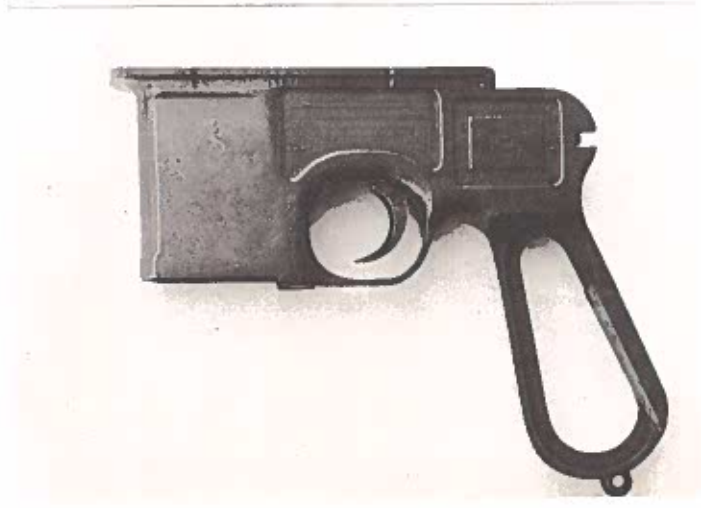

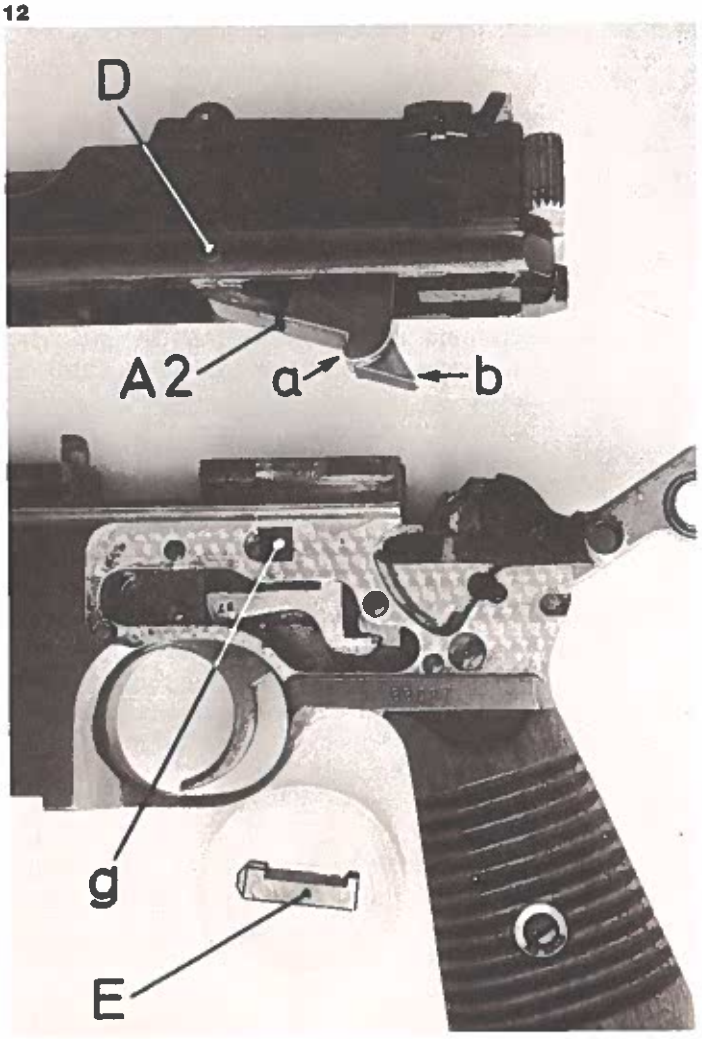

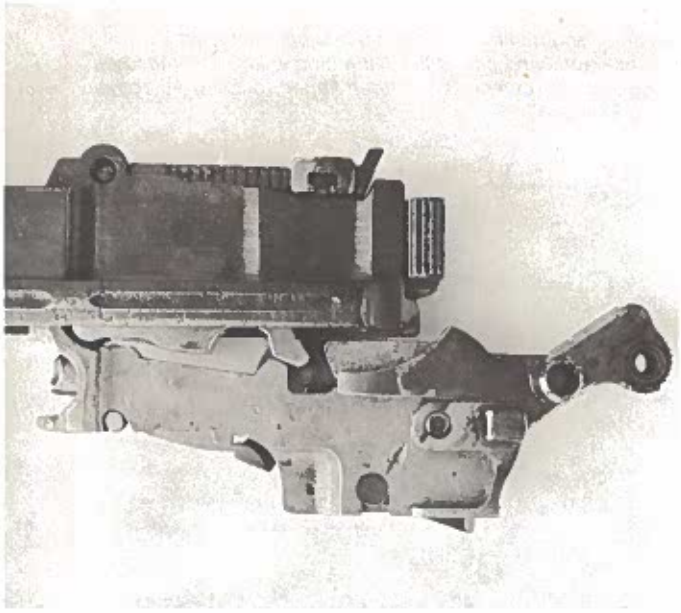

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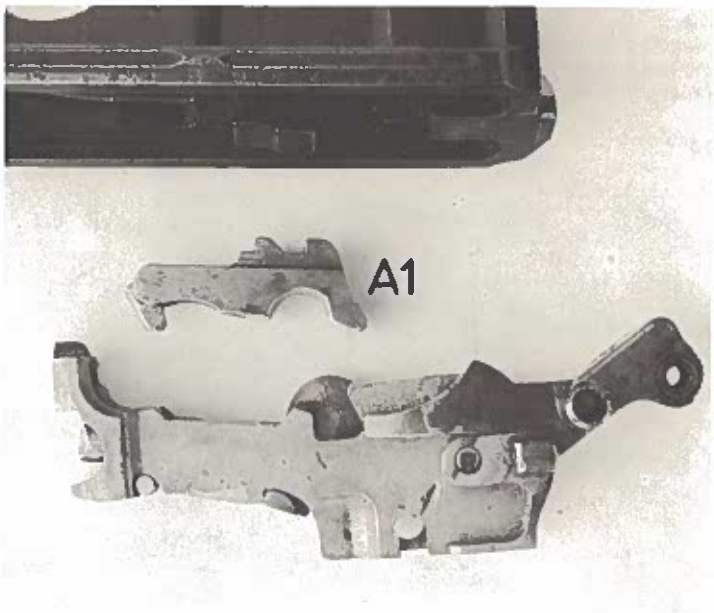


11

breech block and hammer travel in exact unison on the return cycle. The extra impact of the falling hammer (due to its own spring and the shortness of its prescribed path, in comparison with the relatively long homeward journey of the breech block) is thus thwarted. In other words, by the time the breech face reaches anywhere near its home position, the energy of the falling hammer will have been spent and the firing-pin spring will have retracted the firing pin back into its housing. In this case the cartridge would have been chambered but not fired, and the pistol would have to be cocked by hand in order to fire the shot.

To prevent either of these contingencies from cropping up, the Astra people drilled a hole (u) beside the hammer in the receiver (illus. 19) to take up a plunger and spring. This plunger L (illus. 20) has a milled-out locating nose which protrudes into an arched recess in the shoulder of the hammer, the edge of which keeps the plunger compressed. This arched runway is similar to the groove for the safety catch on the other side of the hammer shoulder. When the hammer is in the cocked position the plunger can surface into a cutaway (in the top part of the hammer shoulder, see illus. 19), whereby the lateral nose of the plunger holds the hammer back. Not until the breech block has virtually completed its homeward cycle is the plunger forced down its well again, permitting the hammer to fall. This positive hammer retarding system is perfectly safe.

When the weapon is on "automatic" the trigger releases the first shot only, the subsequent shots are re-

7
Left: 20-shot Mauser magazine. Right: 10-shot Astra magazine Both firms produced 10- and 20-shot magazines for their machine pistols. e = latch lip, i = stop, f = notch

8
Astra model 901 in holster-cum-shoulder stock

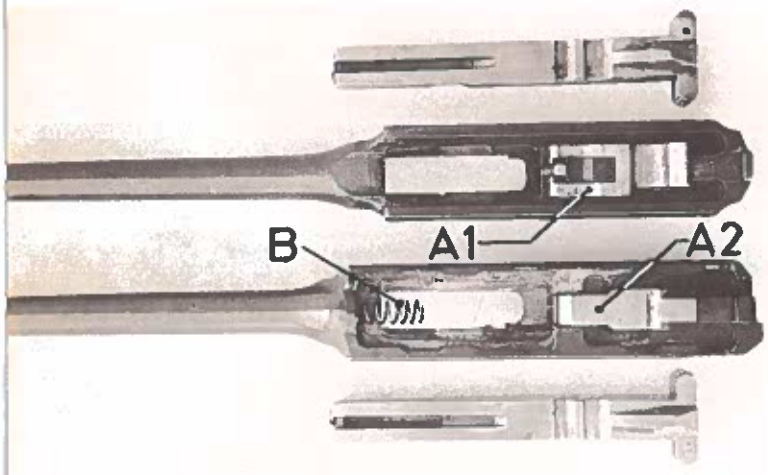
9
(top) The Astra model 900 receiver. c = recoil-spring stay. p = hole in which a nail can be inserted to clamp hammer spring (bottom) Mauser C 96 receiver

10 *and* **11**
How the locking link Al of the Mauser functions.

12
The Astra locking system. A2 = locking link, a = hook, b = wedge, D = hinge pin, E = post, g = opening for post E

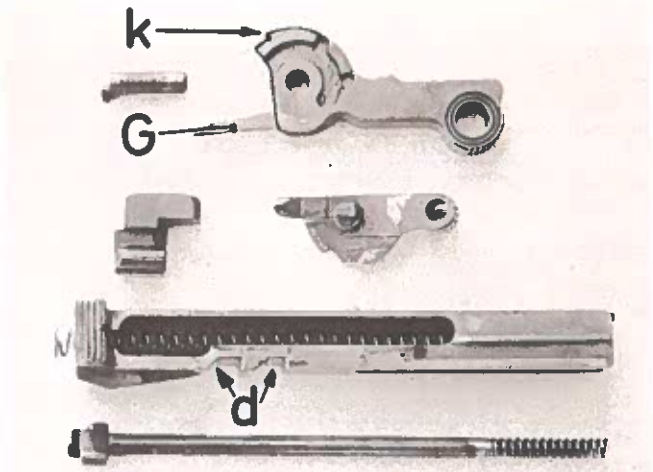
13
Mauser C 96 barrel assembly (in Cal. 9 mm), as compared with the Astra barrel assembly. The top and bottom pieces are the breech blocks. A1 and A2 = locking links, B = recoil spring

13



14
(top) Hammer and hammer pin, spring retainer, safety catch, breech block and firing pin, of the Astra model 900. d = recesses for locking link, k = detent, G = hinged finger. (bottom) As above, but for the Mauser C 96

14



15
Trigger mechanism of the Astra model 900; M = trigger pin, N = sear, I = upright finger, O = lug, P = pawl, Q = pawl spring, U = coil spring

16
Lock frame and barrel extension of Mauser C 96 (link in locked position) R = sear, S = disconnector

17 and 18, Astra model 901:
For single shots the crossbolt of the selective-fire switch limits the length of pull of the trigger
For full automatic fire the crossbolt allows the trigger to force the sear back further which, in turn, keeps the pawl from engaging in the hammer detent.
N = sear, P = pawl, T = crossbolt of selective-fire switch, U = coil spring, W = stop pin to support hammer when slide has been removed, l = extension, m = extension

leased by this plunger, controlled by the reciprocating breech block, by bobbing up and down, so long as the trigger is squeezed.

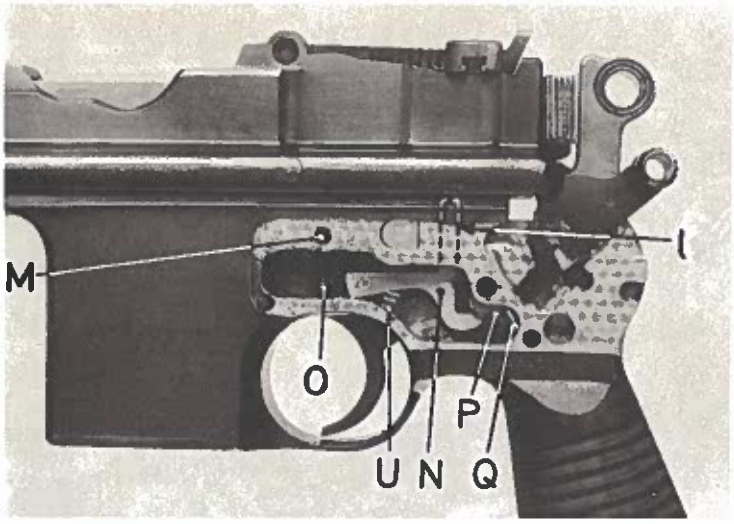
In the Mauser machine pistol the hammer retarding catch is in the form of a lever V attached to the lock frame (illus. 21). This is perhaps a slightly more favourable solution, as a swivel-mounted lever is less subject to friction than a bobbing plunger. Moreover, a swivel-mounted lever is less prone to jamming. On the other hand, the Astra system is the more rugged of the two. In fact, it may be said that both pistols offset their advantages and disadvantages about equally. Nonetheless, the Astra undoubtedly has the disadvantage when it comes to stripping.

In actual practice it is impossible to fire a pistol like a machine gun, since the muzzle climbs so steeply that the shots go wild. That is why these so-called machine pistols were issued with wooden shoulder stocks. To get around this problem the Spaniards went a step further and designed the Astra 903. This model has a retarding mechanism that cuts down the rate of fire to about 5 shots per second. Unfortunately. I was unable to find anyone who had one to lend me.

Stripping

I do not think it expedient to go into the details of stripping the Mauser. This information can be found in most gun publications of German pistols. To strip the Astra the first thing is to insert a bullet or the stub of a pencil in the hole of the magazine base

15



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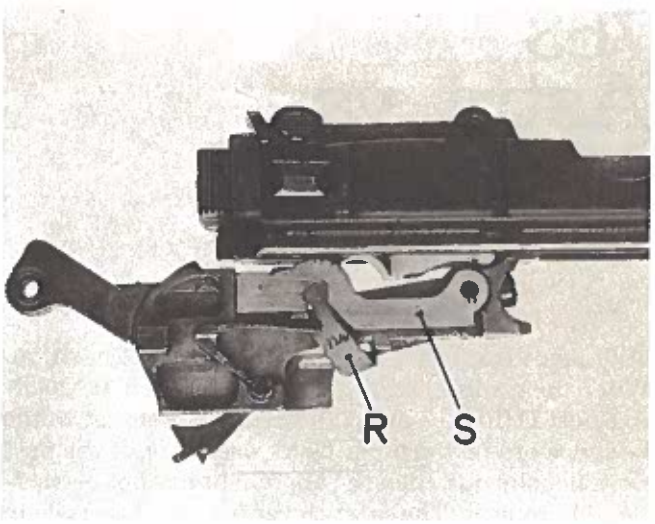

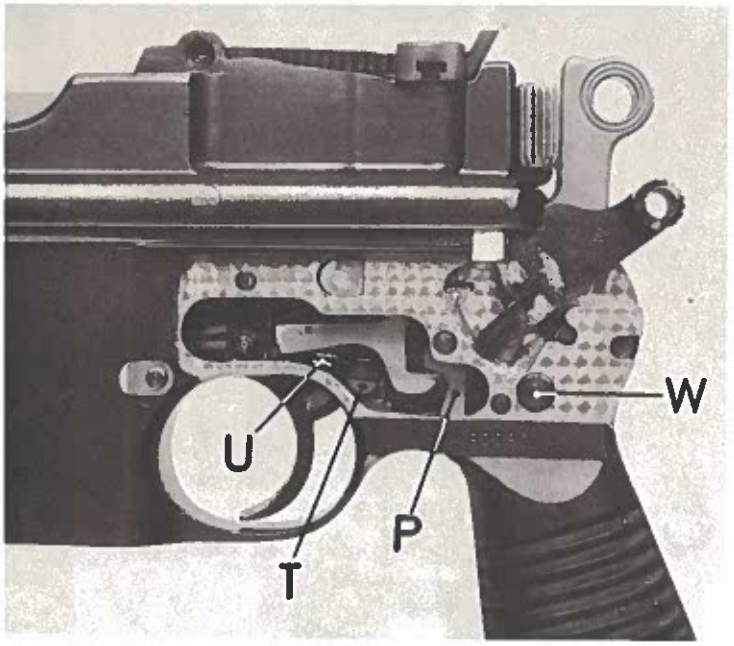

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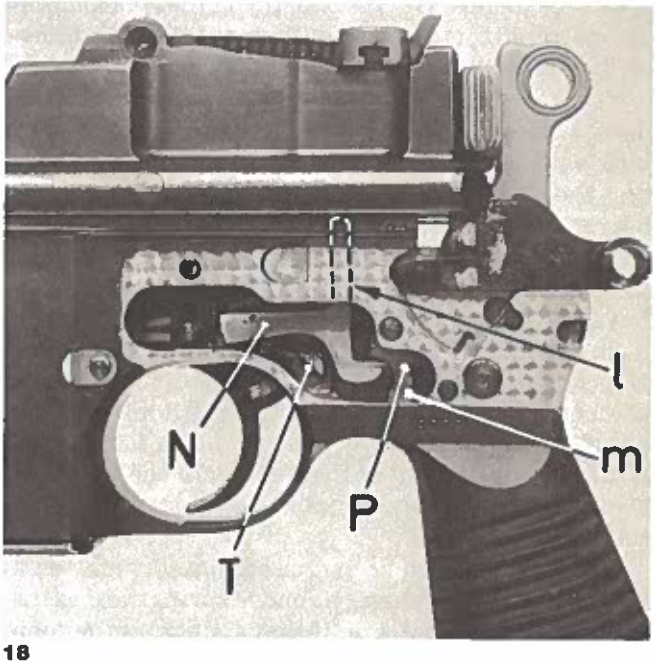


18

plate, as with the Mauser. Press up against the locking stud, then slide out the magazine base, spring and follower. There are a number of things you can use instead of a bullet to release the magazine locking catch, but I strongly advise against using a screwdriver.

To remove the cover plate (the side with the inscription on it) the trailing edge of the safety lever must be aligned with a mark engraved on the cover plate. If the hammer is cocked and the safety lever is on "safe" it is easy to make this alignment, but if the safety lever is on "fire" the hammer will have to be thumbed back as far as it will go (beyond the engaging position!) before the alignment can be made. Easier still is to drop the hammer and make the

Main data for the Astra model 900

Calibre	*7.63 mm*
Barrel length (including chamber)	*140 mm*
Rifling	*6 twists (right hand)*
Overall length	*294 mm*
Overall length with shoulder stock	*643 mm*
Width of slide	*31 mm*
Width of handle	*34 mm*
Overall height	*155 mm*
Weight (empty)	*1.30 kg*
Weight with wooden holster	*1.85 kg*
Sights	*Graduated from 50 –1000m*

Proof marks:

7.63 Astra vs. Mauser C 96

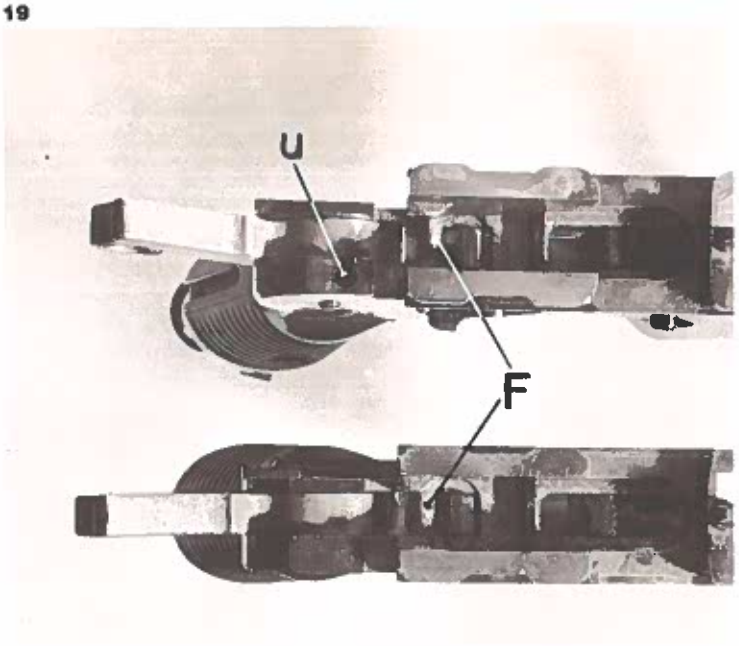
alignment from either the "safe" or "fire" position. When the trailing edge and the mark match, the locking post C (illus. 2 and 22) can be shaken out to the left. A word of warning: Don't use force. If the post does not slip out, then the alignment has not been effected properly. The safety lever fits very precisely in groove (h) of post C (illus. 22). If you find pock marks on or around this post you will know that some bungler has been at work with a hammer.

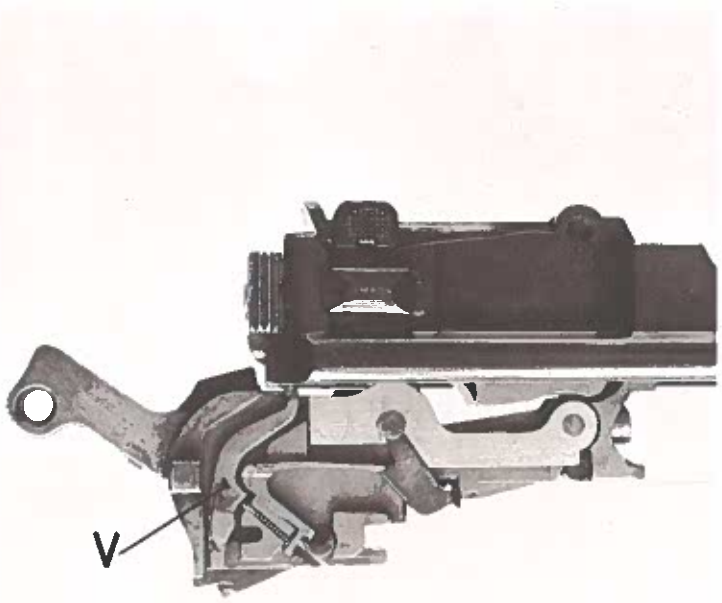
Now take down the cover plate. If you want to remove the barrel assembly from the receiver you had best slacken hammer tension to facilitate uncoupling the slide from the receiver. For drawing off the barrel and barrel extension, the second post E must be removed. This is best accomplished by putting pressure on the muzzle (similar to the Luger) to relieve the downward tension of the link A2, exerted indirectly via the recoil spring B (illus. 12). Once post E has been removed the barrel assembly may be slid off frontwise. Watch out: See that you don't twist the recoil spring B (illus. 13), the first coils of which will either be sticking out of the receiver or the barrel assembly. To assemble, simply reverse stripping procedure.

Great care should be exercised should you wish to take down the hammer. Hammer springs are extraordinarily powerful, and if they fly across the room and hit anyone, irreparable damage can be done. The Astra technicians have provided some degree of safety by drilling a small hole in the backstrap (illus. 9), into which a strong nail can be placed to hold the spring down, once the hammer has been cocked to compress the spring.

By removing the hammer pin K (illus. 22) the hammer can be easily lifted out of its seating. Pin W (illus. 17) is solely a deflector for the hinged finger G (illus. 14) when assembling, and a stop when the slide has been removed. An arbour or special tool must be used to compress the hammer spring slightly if you wish to take it out. Use a vice to have both hands free. Once you have removed the nail from hole (p), with the other hand gingerly let the spring come up (using the tool). When assembling the hammer, see to it that the tip of the hinged finger G fits into the hollow of

19





21

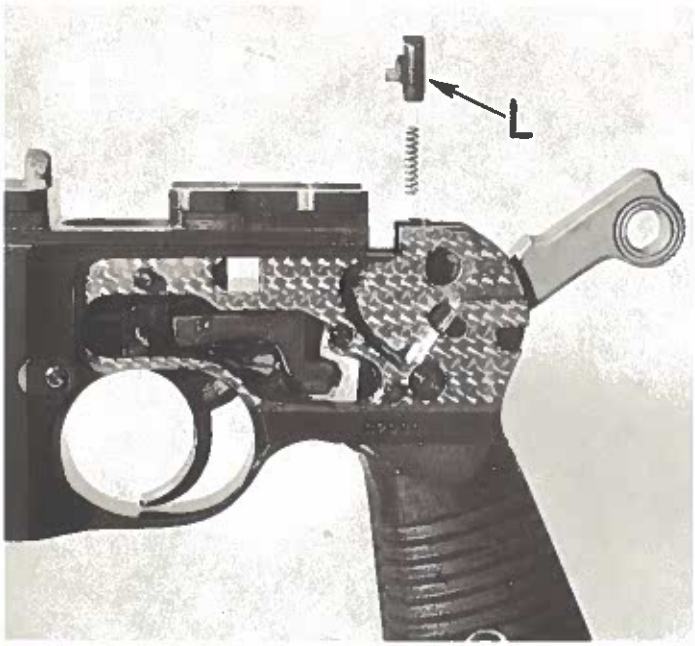
19
(top) Astra model 901 F = deflector, U = recess for plunger L. (bottom) Astra model 900

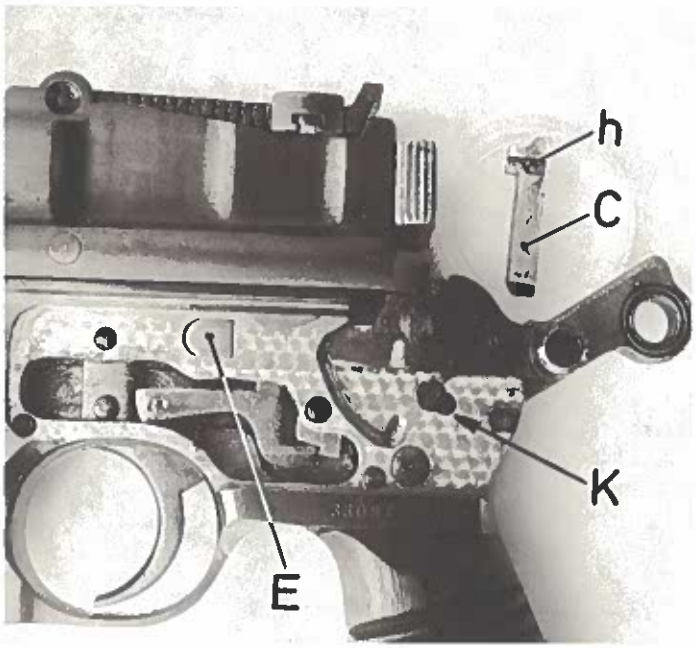
20
Astra model 901. Plunger L and spring – retards the hammer until weapon is locked.

21
Lock frame and slide of the Mauser machine pistol (1932). Catch hook V retards the hammer until the weapon is locked.

22
Astra model 900: Cover plate removed. C = cover plate locking post, h = safety-catch groove, E = post, K = hammer pin

20





22

the spring's cap. It usually drops in without much trouble, but sometimes you have to jiggle a bit. The pin W deflects the hinged finger into the right position, so it is wise to slide the pin home first.

When stripping the models 901 to 903 additional care must be taken as the plunger L (illus. 20), the timing device for the hammer, will unexpectedly fly out when the barrel assembly is removed, i.e. if the safety lever has been left in alignment with the mark on the cover plate. So when stripping these machine pistols make double sure that all the doors and windows are closed! If you lose this plunger it will be very difficult to replace. The right thing to do is to flip the safety lever on to "fire" once you have lifted off the cover plate, the plunger is then held by friction. The trigger assembly requires a bit of fiddling, the parts being cramped in a limited space. However, the pins M and O (illus. 15) can be easily knocked out to the left. All the hinge pins and bolts, except for the link pin, can be readily knocked out to the left, too. The trigger is not so simple to take down; it takes a bit of time finding the right position. The pawl P and its hairpin spring can be lifted clear with little effort, but it is a nasty job putting them back again. The sides of the hairpin spring are short and you will have to fumble around to lock it back into place.

As stressed before, never use force on a gun. If a part does not do what it is supposed to do, then, more likely than not, you have done something wrong. Don't beat anything with a hammer and see to it that you use protective jaws in your vice. It is painful to see valuable weapons that have been botched up by incompetent hands.

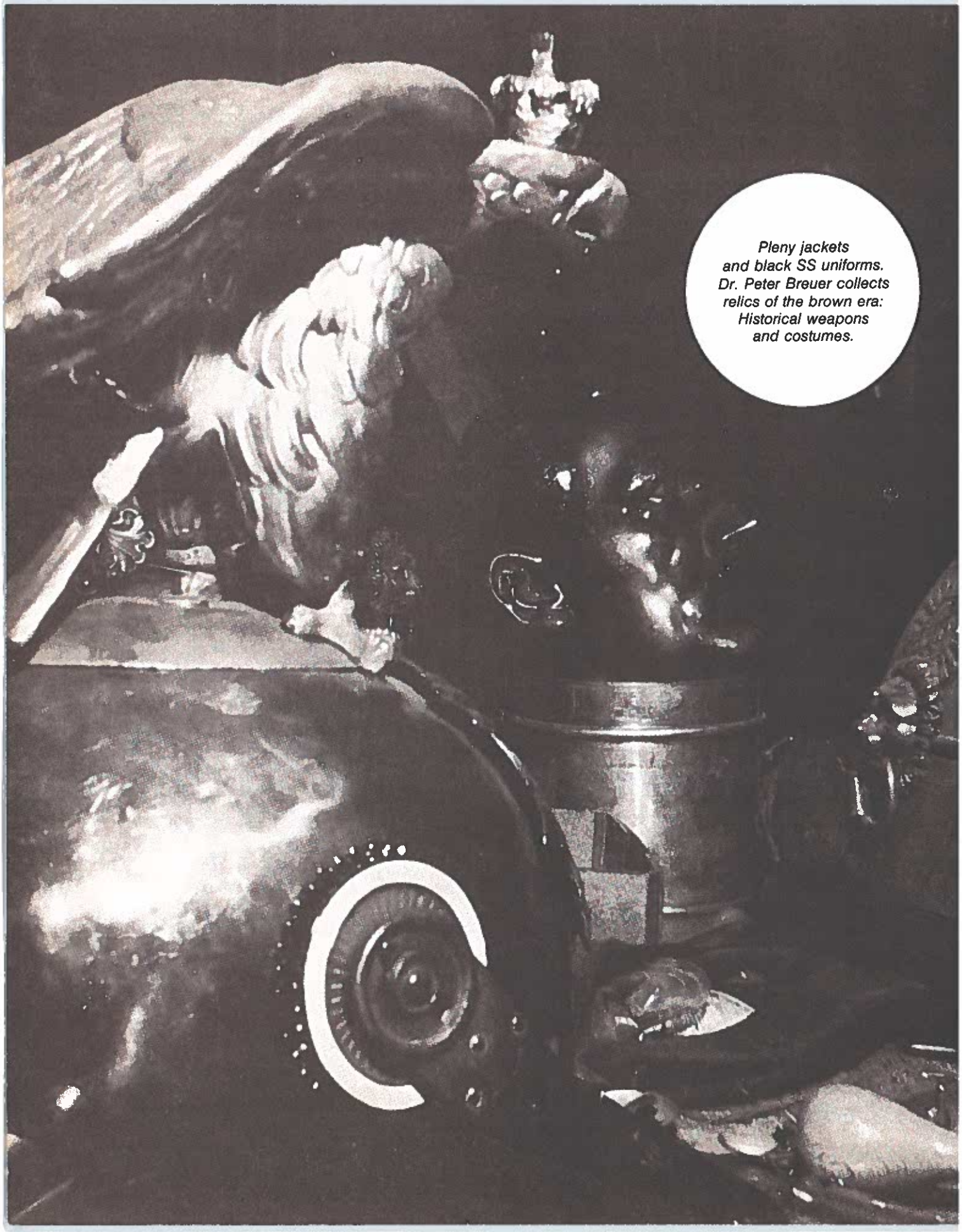
The serious gun collector will, of course, in time buy or make the proper gunsmith's tools (special-fitting screwdrivers, etc.) or at least have on hand a set of brass punches, etc.

<u>The inscription on the cover plate:</u>

"ASTRA" AUTOMATIC PISTOL CAL 7,63
PATENTED JULY 12, 1928
Unceta y Compãnia GUERNICA "Spain"

The proof marks are on the right-hand side of the barrel and on the receiver. The serial number is stamped over the wooden stock and on the frontstrap (covered by the stock). The last two digits of the serial number are stamped inside the walnut grip plates.

Finally, I should like to say that all four models of the Astra Mauser-type pistols are cleverly designed and constructed, and that their performance is excellent. Truly, worthy copies of the Mauser C 96! They are very interesting pieces to have in your collection and should not be looked upon as inferior imitations.


Pleny jackets
and black SS uniforms.
Dr. Peter Breuer collects
relics of the brown era:
Historical weapons
and costumes.

The Mysterious Chamber of Nazi-dom

An Eye-Witness Account
by Hans-Herbert Frank

An icy whiff of an era fraught with sorrow hung over the shelves and clothes hangers in Dr. Peter Breuer's cramped premises at Hohenzollern-straße 11, Munich. Glory and ignominy have become one in those long rows of piled-up shelves where pompous uniforms and the paraphernalia of the SS and Nazi high officials, together with torn pleny jackets bearing heart-wrenching signs of Soviet POW camps, testifying to the transiency of an ideology, are watched over as if they were gold.

Dr. Breuer is an original. He knows this yet does not make anything of it. Not even when friends think of him as a crank – a crank who passes himself off for a collector. Dr. Breuer lusts after decay, say some – after riches, say others. But I would say this 64 year old is more a dreamer who feels himself called upon to act as a trustee to the property and history of the Third Reich. A history which really is not yet history, but an event still vivid for many of us.

There they hang between drawers and shelves: the uniforms of simple privates, uniforms of military braggarts and the uniforms of callous gangsters: be-jewelled with medals, badges of honour, and swastikas. Swastikas in all conceivable variations, brassards, tie pins. Now and again the ripped jackets of the unfortunate. The vestiges of the recent past, as stored in this rented apartment, abruptly yanks the

Dr. Breuer sued "Paris Match" for damages on account of the article, "Chez les Nazis 66." The Nazi masquerade was staged on his premises. ▶

Top: Steel helmets turned into water carrier and money box. Dr. Breuer repairs a dented helmet.

◀ Between the brown flotsam older uniforms can be found. One of the oldest and most valuable dates from the period of Frederick II.

▲
Two jackets of documentary value: The pleny outfit of a German POW in Russia and a black SS uniform.

visitor out of a state of lethargy. What once was burned or hidden away is now to be seen sorted and refurbished. The contents of these musty rooms soberly sum up the years in Germany between 1933 and 1945.

For contrast, Dr. Breuer held up two jackets of documentary value. The one belonged to a member of the SS, the other to a German prisoner of war in Russia. He likes demonstrating the transiency of military glory; but at the same time his critical eyes wander over the motheaten garments, causing him to mechanically reach out for the spray as though a piece of himself were falling into decay.

"You know," said this military but peace-loving propman, "it would be a tremendous pity if these items were no longer to exist one day . . ."

Most of his income was earned in the hire-out side of his business, I was told. And Dr. Breuer assured me that his profits were ploughed back into his firm. German TV stations and film companies are regular customers at Hohenzollernstraße 11. For nowhere else are so many relicts of the brown era to be found.

Of his 10,000 uniforms, brown flotsam makes up the greater part by far. He possesses 35 to 40 dress coats, now and again a Macedonian or other national costume, or a peasant's bridal tiara – unnoticed, nicely packed in cardboard boxes. It is no wonder, therefore, that a Swiss magazine accused Dr. Breuer of trading on the luridness of the swastika. The French magazine, "Paris Match," went a step further and staged on Dr. Breuer's premises a Nazi masquerade.

The article, "Chez les Nazis 66," in "Paris Match" flashed around the world, holding Dr. Breuer up to infamy over night. The French journalists had taken advantage of this gullible old gentleman to get him with others to pose as neo-Nazis, in order to cause a new war scare. Jean Taoussou's article, although faked, caused such a stir that at one time the relationship between Paris and Bonn became politically strained. Dr. Breuer has sued "Paris Match" for damages (20 000 Francs), not so much because of per-

We are sorry to inform our readers that Dr. Breuer died soon after this article was written.

◀ *Left: "When one knows with what devotion and care and patriotic faith guns were made, then they can be put on a par with the cultural value of the finest furniture."*

Top: Historic helmets. Eating utensils, a home-made comb and a wartime letter from the loved-ones.

Bottom: Valuable weapons and dummies. The remains of a turbulent era: Hitler bust and Stalin portrait on a bright yellow background.

sonal insult, but because of the defamation of the character of Germany's youth. "I was under the impression that the French counsel for the prosecution (ex-officer Damien) was foaming with indignation."

"I pay good prices for steel helmets, Prussian spiked helmets, shakos, swords, sheaths and scabbards, halberds, antique guns, pistols and revolvers, holsters and cartridge belts and bags, lances, ar-

▲ *Among his treasures the 64 year-old Dr. Breuer, son of a Rhineland craftsman, has become a philosopher.*

Gun collectors ▶ are welcome here. "When I see someone knows what he's talking about, I serve him well." Regrettably, the critical visitor is confronted with hotch-potchy confusion. Many valuable weapons are being eaten away by rust.

mour, cuirasses, etc." Truly, his omnium – gatherum seems to be immeasurable! Dr. Breuer buys and hoards everything in the semblance of a weapon, be it a dagger or a cannon from a Chinese junk. Dr. Breuer collects – everything else takes second place. However, those enthusiasts who expect the weapons to be highly polished and in tip-top condition will be disappointed.

Nonetheless, Dr. Breuer has a good nose for estimating the value of a weapon and offers his services as adviser and valuator. With a passion bordering on schizophrenia he had devoted much of his life to the metier of collecting and had developed a subtle knack, he said. "I'd say prices are going up; for the gun as an object of value and a work of art is too little realized." Dr. Breuer as folklorist: "When one knows with what devotion and care and patriotic faith guns were made, then they can be put on a par with the cultural value of the finest furniture. There is a pause in both fields."

This gun and costume collector has also developed a passion for curiosities. For example, there is the WW2 steel helmet which has been converted into a money-box, and a uniform dating from the period of Frederick II (The Great) – whereby there hangs a tale. Dr. Breuer purchased this uniform over the telephone, believing it to date back to about 1850. Later he found out that he had caught a big fish. During the 19th century it had been provided with new collar patches and new cuffs, but underneath the originals were still in excellent condition. Guardedly, Dr. Breuer answered my question as to where he gets so many uniforms and guns. "The best source is rag-merchants and small-time second – hand shop owners . . ."

On the other hand, Dr. Breuer was more willing to tell me about how he in Jülich, nearly 50 years ago, had given his landlady his officer's uniform to store away, and how after returning he had found, in addition, English, French, Belgian and American uniforms complete in good order. "It was then that the idea struck me to collect more."

Dr. Breuer has been skilful in exploiting his hobby. The price list: Greatcoat of an SS-Sturmbannführer, 46 dollars; SS jackets of Scharführer to Hauptsturmführer, 42 dollars; greatcoat of an SS-Obergruppenführer, 65 dollars. A black SS-Sturmmütze (cap) can be had for 22 dollars, and replicas of SS caps range between 4 and 7 dollars. The American "SS craze" refuses to ebb, so Dr. Breuer is having replicas made of the most popular items. "I have an excellent tailor working for me . . ."

A Gunsmith Dynasty: Zanotti

Text by R. Horlacher

The reputation of the House of Zanotti, founded in 1625, is based on tradition and quality. The name is still in good repute, for the Zanottis are one of Italy's leading gunsmith families. Like artists, each generation has remained true to the principles of creating valuable handmade weapons which are unique with regard to their finish, design and precision. This still holds true today. The firm was founded during the 30 Year War. Cassiano Zanotti I (1593–1665) walked all the way to Prussia to find work. However, he did not return to his homeland to work as a miller like his forefathers.

Cassiano I decided to remain in Brandenburg and become apprenticed to a gunsmith. Then, about 20 years later, he returned home as a much-respected artisan for, as everywhere else at that period, gunsmithing was a highly thought-of profession in Italy. In the vicinity of the town's castle the count assigned him to a workshop.

This same workshop may be viewed by anyone visiting Santa Maria Fabriago, in the province of Ravenna. The presant owner, Fabio Zanotti (1903) with his son Stefano (1945), direct decendants of Cassiano I, are determined to uphold this family heirloom.

1

2

1+2 *Fabio Zanotti and his son Stefano*

3

3 *Old workshops and estate at Santa Maria in Fabriago*

Replica of a flintlock pistol made by Sign. Cassiano Zanotti c. 1768.

Each generation worked as gunsmiths and over the years made changes and improved the lock mechanism. Cassiano I. had two sons, Stefano and Pietro. However, it fell to the founder's grandson, Cassiano II (1706–1785), to become the greatest gunsmith Italy had ever known. His creations were the by-word for precision and beauty and it was his uncanny skills that rocketed the name of Zanotti to fame. Stefano II, Cassiano III and Pietro, as documents show, were great gunsmiths, too.

Napoleon I, when King of Italy (1805), ordered several guns from the Zanottis. In fact, a friendship was struck up and Napoleon talked Cassiano III (1773–1812) into joining the French forces. As a renowned armourer he was quickly promoted to officer rank. But his new career ended abruptly when he fell in the Russian campaign. In recognition of his services, his family was awarded with land and property which remained in the Zanotti family for half a century.

However, on account of revolutionary activities,

N.° 1852 P. S.

GOVERNO PONTIFICIO

REGGIMENTO CARABINIERI

COMANDO DELLO SQUADRONE DI ROMAGNA

Forlì li 13 Maggio 1831

Si permette al Sig. Zanotti Pietro nativo di S.t Mauro di professione Archibugiere di portare a propria difesa qualunque sorta d' armi, siccome Persona di nostra piena fiducia.

VALE PER MESI N.° 6.

Il Tenente Colonnello Comand.te lo Squadrone

4 *A gun license dated 1831, in which the gunsmith Pietro Zanotti receives permission to carry any weapon for personal protection, as he is trustworthy.*

5 *Selfcocking side-by-side shotgun, sidelocks, single trigger, barrels made from "Böhler-Spezial-Super-blitz" steel.*

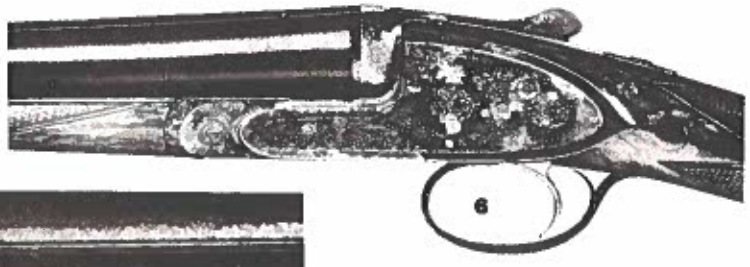
6 *Four-barrelled percussion gun with single trigger, made for King Victor Emanuel II, 1864*

Pope Pius IX was forced to prohibit, under the penalty of death, the making of firearms or the carrying thereof. This ban was not lifted for 20 years and ruined many Italian gunsmiths. The Zanottis, in secrecy, carried on in a small way, but in time were compelled to relinquish their estates.

The technical advance in firearms in the second half of the 19th century, brougth with it a fresh impetus for the Zanotti dynasty. They turned their attention to the manufacture of Derringers and were purveyors to King Victor Emanuell II and later to King Nicholas I of Montenegro. Towards the end of the 19th century the Zanottis turned their skills to hammerless shotguns, competing against famous English houses, e. g. Purdey, Westley Richards, and others.

In 1906 the Zanottis won the Grand Prix at an international exhibition in Milan. They were granted patents which, subsequently, were used by other manufacturers. At the beginning of this century the Zanotti family expanded in size. All the male issue were put in the parental workshop to uphold the family tradition of fine guns. Giacinto (1836–1919) and Tomaso (1864–1946) introduced numerous improvements to their family's weaponry skills. Both world wars put a stop to the manufacture of luxury firearms. However, today, Fabio and his son are again, according to the inherited maxim, producing only the finest of guns to carry on the family name.

Zanotti flintlocks can be admired in valuable collections. Cassiano II designed, in 1768, a particularly eye-catching pistol displaying exquisite woodwork and beautiful engraving. In remembrance of this great gunmaker, Fabio and Stafano have produced this pistol again, in a limited series. The ornamentation, side plates, trigger guard, etc. are of massive sterling silver. The Zanottis also produce shotguns with sidelocks, arabesque engraving and English-type stocks (of choice woods) that can compete with the best of British products any day.



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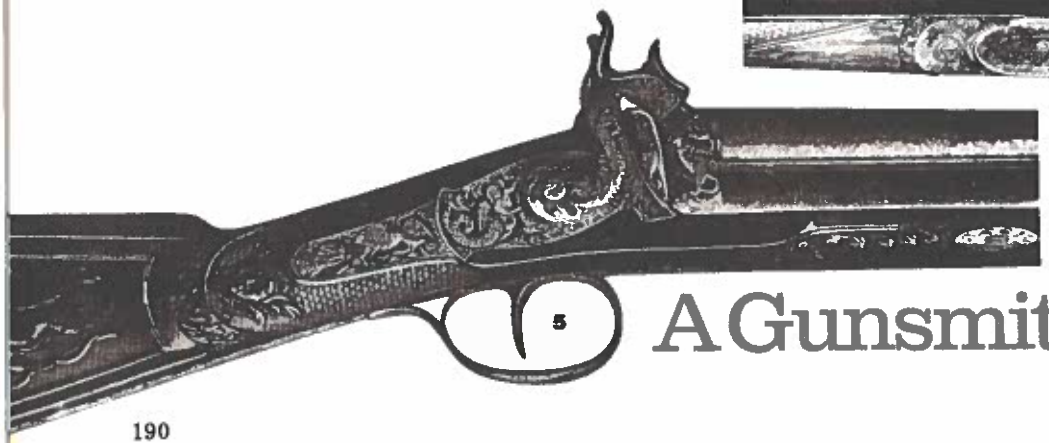
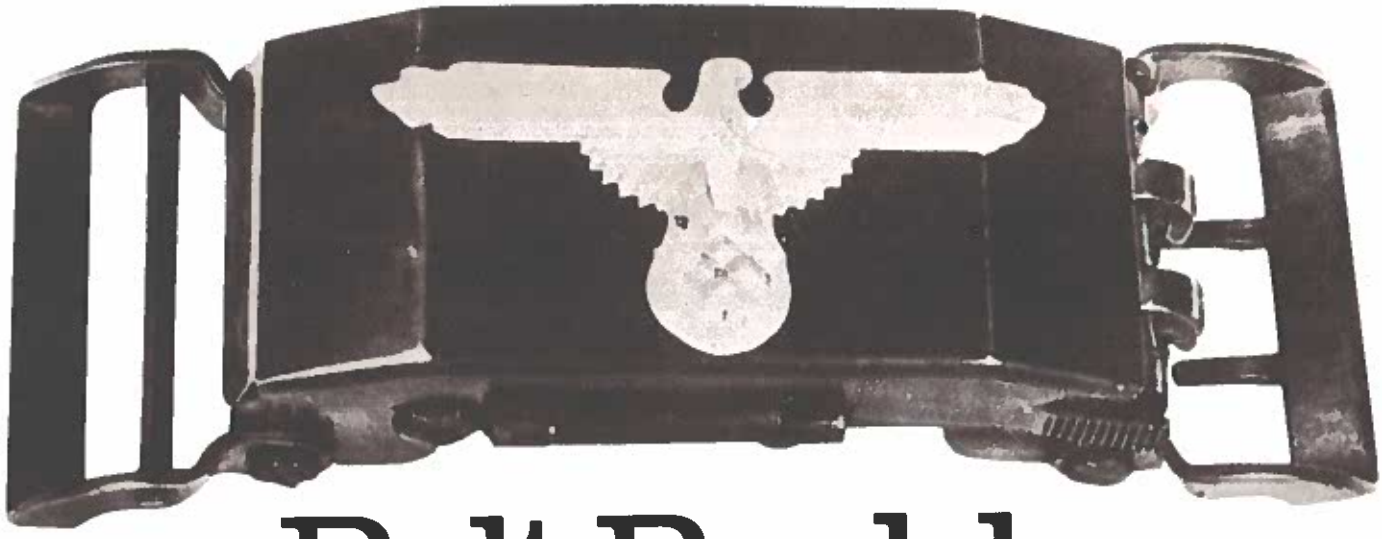


5

ZANOTTI: A Gunsmith Dynasty

Zanotti flintlock pistol

Horst Schankliss



Belt Buckle Pistols

The account was simply too awe-inspiring not to be told, it also vindicated the American view of the Germans at the time. A top Nazi had been cornered and placed under arrest, he faced his captors and, pale and quivering, made a movement as though he wanted to surrender his military belt – bullets whistled through the air. Thereupon the Nazi stepped over the squirming bodies of the MPs and made off – as free as a bird. And if the "hero" of this anecdote is still living, he's enjoying himself in the South American sunshine, etc.

In Germany this story was hardly known, the people there had other problems. Is this tale truth or fiction? It is a fact that the Allies had captured a firing mechanism that could be used in a belt buckle. But whether this pistol ever saw service is another question. There are extremely few belt buckle pistols around, most of them prototypes. This device was never mass produced, as the Allies had bombed the plant before this enterprise could get off the ground. The few that did turn up intact became jealously guarded spoils.

In Germany virtually nothing is known about these pistols. When, in 1966, we published a picture in the German edition of International ARMS REVIEW, the public echo was slight. However, we did receive letters that put us on the right track. In fact these leads led us to the designer's family. We thank his wife and daughter for the material that has made this report possible. The photos were supplied to us by Dr.-Ing. Spangenberg. He wrote: "In 1961, while travelling in France, a French officer showed me a German belt buckle pistol. As he kept his hand on it all the time, it was impossible to make a proper inspection. However, I managed to take a few pictures. Contrary to the pistol you published with two barrels, this one had four in cal. 7.65 mm (Browning)."

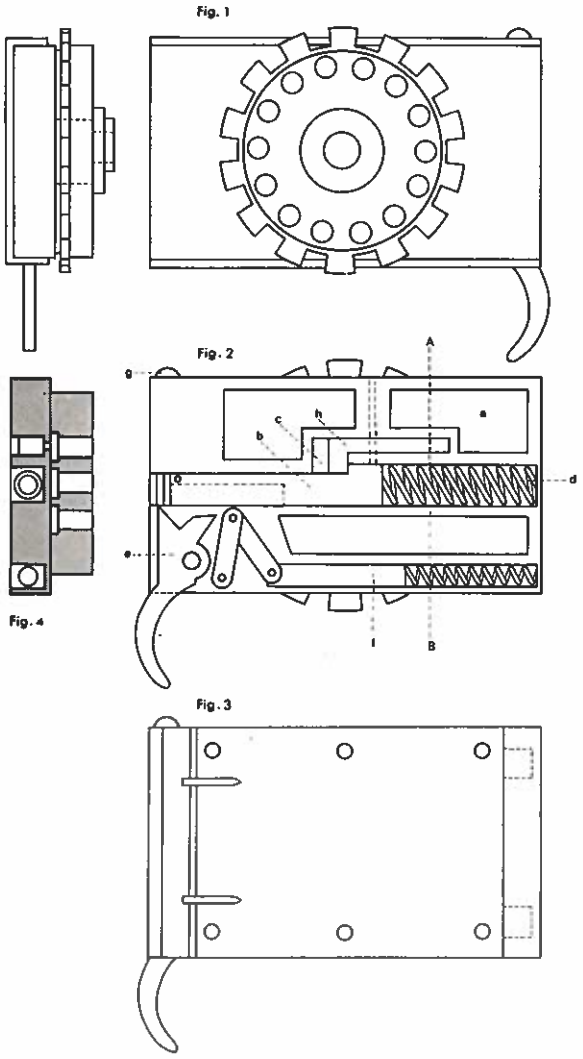
The first patent granted for the so-called "rapid-firing device" was dated 7th March, 1934. Under the number 608227, a "cylinder revolver in the form of a belt buckle" was registered at the Reich Patent Office. The certificate issued testifies that, "Herr Louis Marquis jr., in Wuppertal-Elberfeld in the German Reich, applied for patent rights at the Reich Patent Office on 27th May, 1933, for an invention designated 'belt buckle.' The attached papers are correct and exact copies of the orig-

inal documents of this patent application." The drawings are shown in illustrations 1–5. Fig. 1 shows the front view of the belt buckle pistol; Fig. 2 the rear view when dismounted from the buckle: a) the box-type housing, b) the striker with wedge-shaped projection (c), d) the striker spring, e) the trigger, f) the loading mechanism and g) the safety catch which automatically functions, although only shown by way of suggestion in the drawing. The ignition lever, h) is in line with the wedge-shaped projection of the striker.

Let us read how the inventor described its mode of operation in his patent application: "As soon as the trigger is put into motion a cam simultaneously opens the safety. Then the larger cam profile of the trigger presses against the striker, in the following moment the loading mechanism is actuated, whereby the striker is still being pushed in a rearward direction.

"During this phase of operation loading is fully completed, and shortly after loading has taken place the striker flies forward, the wedge-shaped projection of which, at the last moment, slams the ignition lever upwards causing its point to ignite the cartridge.

"In this case ignition is caused via a horizontal stroke. However, the ignition of the cartridge can be effected in another manner, via an oblique stroke, for example; everything of which belongs to the



character of the invention, whether known or unknown.

"The storing of the reserve cartridges can also be done differently, for example, by employing a magazine, a cartridge belt, or a similar device. It is emphasized that there are many other forms which, however, all remain within the borders of the invention, as technically these other forms are equivalent in attaining the same object.

"The back plate of the pistol can be flat or curved to allow this firing device to be brazed or screwed to various types of buckle.

"Blanks, shot or coloured dyes can be used instead of bullets. The number of shots fired at one time can be increased in that the ignition lever is fitted with the number of pins required or by a similar method, whereby the magazine would have to be correspondingly changed.

"Each of these and similar possibilities belong to the character of the invention."

It is obvious when reading this extract of his patent application that Louis Marquis wanted to protect his patent against patentable improvements that might have come later. But he was not successful; for the letters patent specifies the claims separately. Figures 6–12 prove that the inventor had been busy improving his pistol between 27th May, 1933, and 7th March, 1934, the date he was granted patent rights. The Patent Office did not comply with Marquis's all-round covering for unforeseen events. The claims are itemized in 5 points:

1) A cylinder revolver in the form of a belt buckle, characterized by the fact that the upper end of the trigger, the part protruding into the housing, is bifurcated, the larger profile of which actuates a horizontally sliding member against spring pressure, thereby cocking the striker while the smaller profile actuates the cylinder.

2) Belt buckle according to claim 1, characterized by the fact that the sliding

1 *shows the front view*
2 *the layout of the mechanism*
3 *the rear view*
4 *a cross section from Fig. 2, section C-D*

member which, after actuation of the trigger is released and which then returns to its home, strainfree position, is provided with a wedge-shaped projection (n).

3) Belt buckle according to claims 1 and 2, characterized by the fact that an arrester for holding the cartridge retainer in the correct firing position is provided to ensure an orderly discharge, a device consisting in the gear rim of the cartridge retainer and in a sprung strain bolt.

4) Belt buckle according to claims 1, 2 and 3, characterized by the fact that a spring (1) is provided that forces the trigger mechanism and the loading mechanism, subsequent to firing, into their home positions whereby one of the trigger's profiles glides down the groove of the sliding member (d) it has laterally actuated and thereby lifts the flap (m) of the sliding member, which, after the profile has passed through, closes under spring pressure.

5) Belt buckle according to claims 1, 2, 3 and 4, characterized by the fact that for reasons of safety a safety catch (o) is provided which engages in the sliding member (d).

Here we see that the patent differs substantially from the patent application. The application dealt with a firing device that could be built into belt buckles, whereas in the specification the inventor wants to patent the design of a buckle in the form of a pistol. Hence the explicit nomenclature: "A cylinder revolver in the form of a belt buckle."

The patent specification describes the function and began with the preamble:

"Firearms in the form of box-type containers are already known, weapons that can be built into a belt, etc. It is also true that this type of weapon exists, whereby the magazine is attached to the housing in the form of a ring which is provided with a number of chambers.

"However, all the devices known have an extremely complicated arrangement in regard to transferring trigger pressure to the cocking mechanism, to automatic tripping and to the transportation of the cylinder.

"The belt buckle pistol under discussion, on the other hand, is of uncomplicated design. It is safer in function and easier to use."

It is not difficult to imagine the number of avenues that confronted the inventor and the pile of letters he exchanged with the Patent Office prior to getting this definition accepted. Compare the text of the first patent application!

But let us return to the mode of operation:

According to the invention, the upper end of the trigger, the part protruding into the housing of the weapon which is designed in the form of a revolver-cylinder belt buckle pistol, is bifurcated. At the same time a sliding member, horizontally movable, is provided which is actuated against spring pressure by one of the trigger's upper profiles, thereby freeing the striker to move back to a position far enough to cause ignition. The second profile actuates the cylinder.

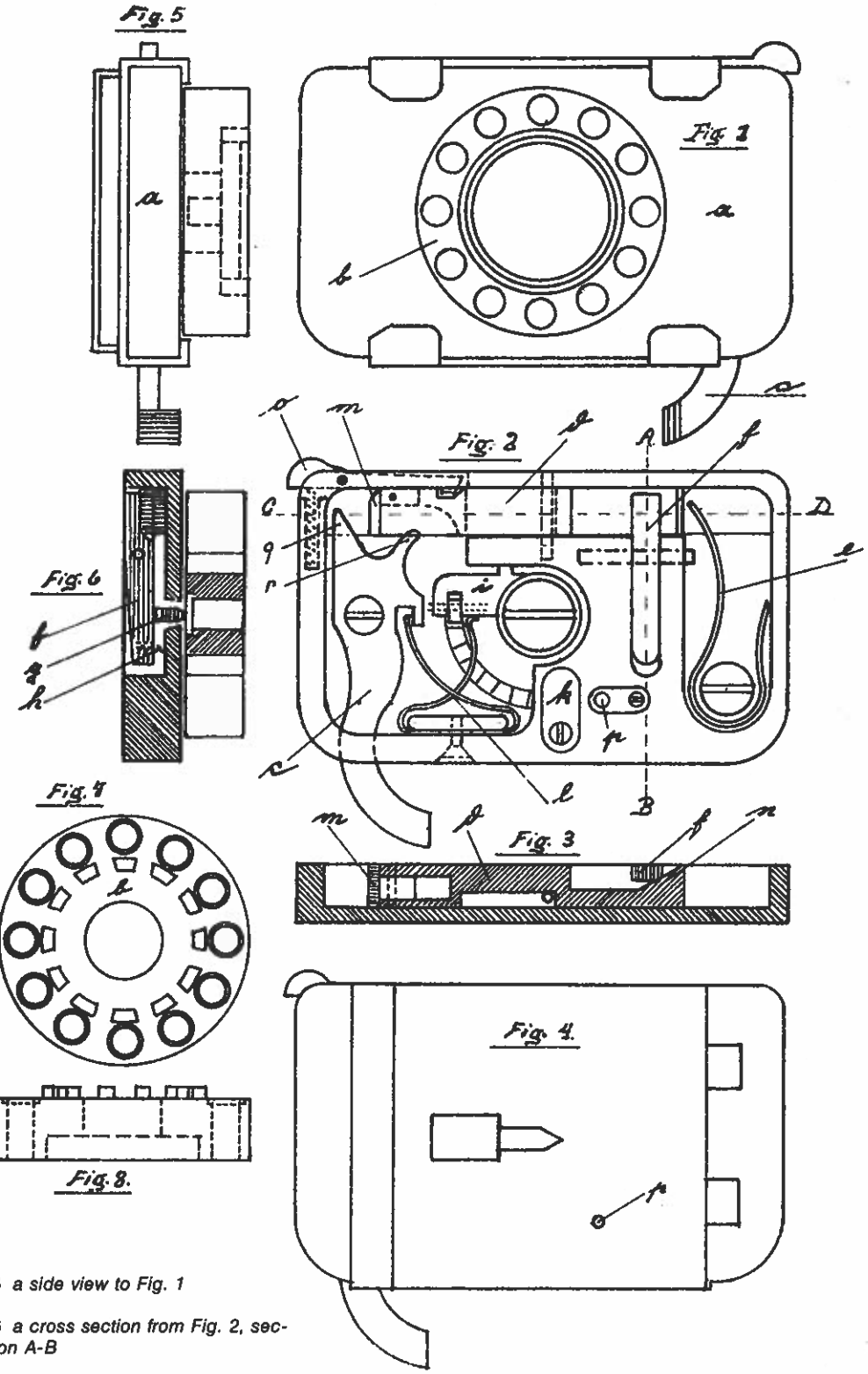
The sliding member is fitted with a wedge-shaped projection on one of its edges for setting the striker in motion, a function, however, that only takes place when the spring is cocked and during the backstroke of the horizontally moving sliding member. The projection frees the striker during the cocking process. An attached spring forces it back in the striking position. When the cocking process has been completed and the sliding member automatically tripped, the projection once again presses the striker to the fore. The impetus gained by this movement is strong enough to cause the striker to override its idle position and ignite the cartridge. The magazine is provided with an internal gear rim in which a sprung strain-bolt engages so that the individual chambers of the magazine are correctly aligned with the barrel(s) and held firmly. The weapon is put on "safe" by applying the safety catch which engages in the sliding member.

However, this catch can be so placed that the trigger is arrested. As mentioned before, the trigger lies sideways in the narrow side of the housing, allowing a parallel movement to the front of the instrument. However, this can be changed to give the striker an oblique movement and to cause the bullet to be fired in an oblique angle to the front of the housing.

The housing is made up of a flat box which is open at the back a). However, the opening can be closed via a slide-in plate and locked in position via clasps, etc. The rear of the housing is in the form of a belt buckle to which one end of the belt is permanently fixed – the other being able to clip in or clip out in the normal fashion. To prevent the box laterally drifting from its rear plate, the sprung pin p) was fitted.

The cylinder (magazine) b) is screwed to the front side of the housing. The shape and nature of the weapon is primarily designed to act as a belt buckle. Nevertheless, the rear plate can be altered to allow the weapon to be screwed or soldered to other suitable devices.

All working parts of this cylinder-operated pistol are encased in the housing; the protruding trigger c) is, according to the invention, bifurcated above its fulcrum point. Profile q) actuates the horizontally sliding member d), whereas the profile r) engages in the cylinder pawl i). The spring l) serves both the trigger and the cylinder, holding both in the home position. The sliding member d) is held in its home position by spring e). In this position the sloping edge n) of the sliding member d) forces the striker arm f) and pin g), against the coil spring h) to contact the primer of the cartridge. The side of the sliding member that interacts with the trigger profile is constructed in the form of a flap m). Moreover,

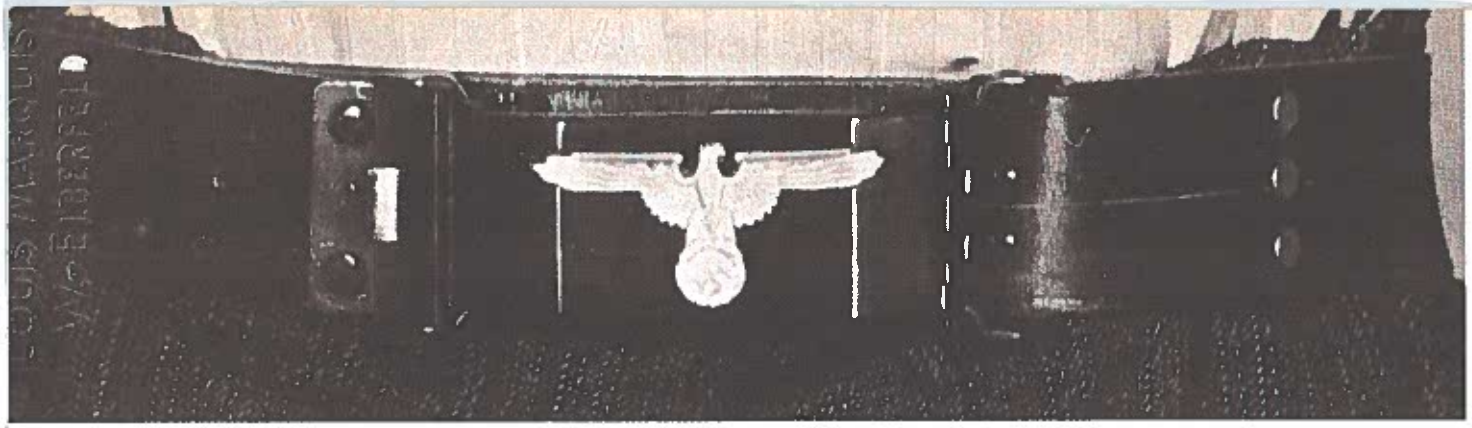


5 *a side view to Fig. 1*

6 *a cross section from Fig. 2, section A-B*

7 *rear view of cartridge retainer (magazine)*

8 *side view of magazine*


LOUIS MARCUS
W.C. FIBERFELT

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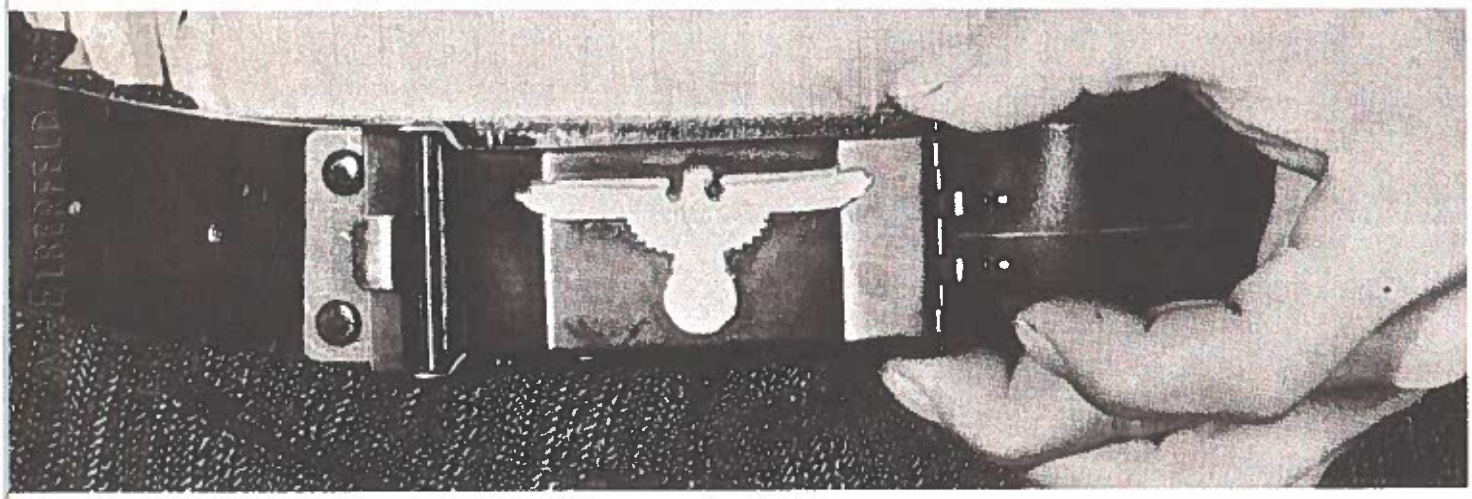
LOUIS MARCUS
W.C. FIBERFELT

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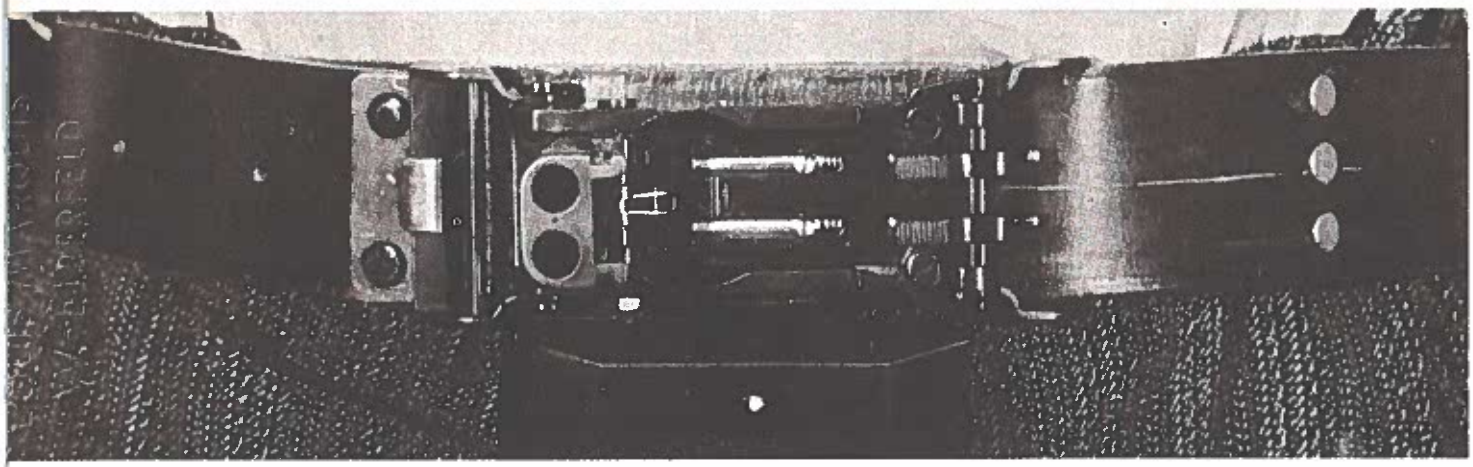
LOUIS MARCUS
W.C. FIBERFELT

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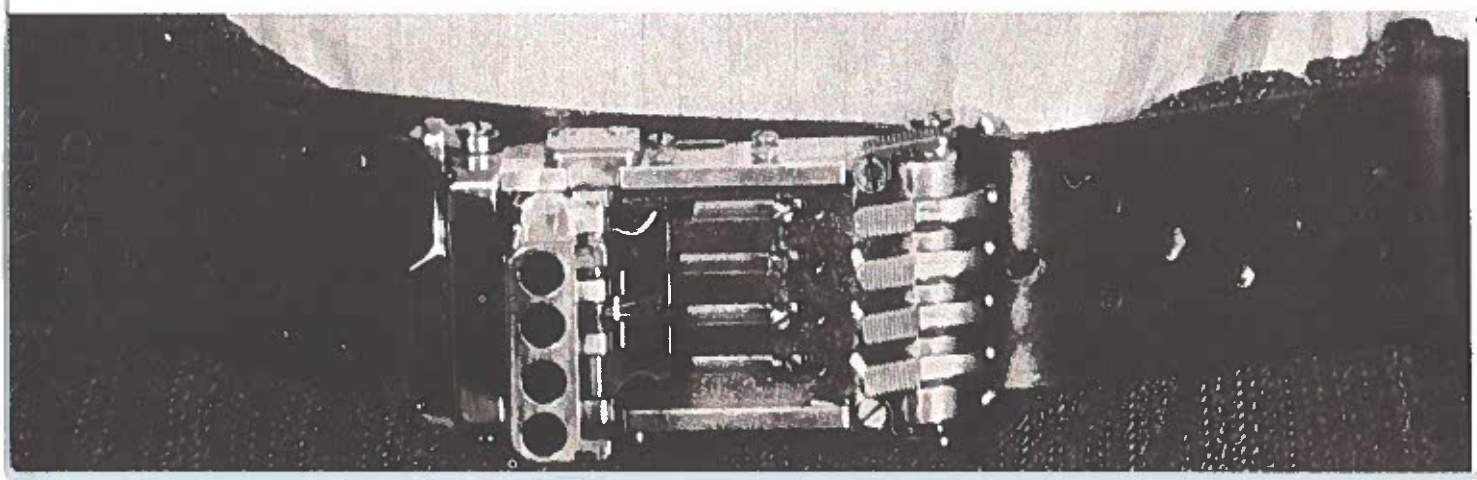


12

9 *Front view of the Marquis*

10 *Getting ready to fire. The catch (actuated with the left hand) drops the face of the buckle. In the four-barrelled version the face flies upwards.*

11 *Ready for action. Each barrel has its separate trigger, right in the picture.*

12 *The four-barrelled version (buckle face removed)*

within the slide, behind the flap, a by-pass is provided for the trigger profile.

As can be seen in Fig. 2, the gear rim runs around the outside of the cylinder. The strain-bolt k) engages in these teeth and holds the cylinder in the correct firing position. In addition, the safety catch o) is situated on the top edge of the housing. Its mechanism is in the shape of a lever and engages, via thumb pressure, in a recess of the sliding member.

The belt buckle pistol functions as follows:

Depress the safety catch. At the same time press the trigger to the side with the index finger. The profile q) contacts sliding member d) and forces it to the right against spring e). As the sliding member begins to move, the slope n) frees the end of the striker f) causing it, via coil spring h), to take up the firing position. As the trigger continues its journey the second profile contacts the cylinder pawl i). The cylinder (magazine) revolves to the next chamber. During this movement the strain bolt k) is pressed out of its locking position, but drops in between the next set of teeth of the gear rim to ensure that the chamber is in the firing position. In the meantime the sliding member has been forced over so far by the profile q) that the profile can slip out of engagement. The spring e) can now push the sliding member back into its home position. Therewith, the slope n) pounds the striker arm f). The impetus gained by this movement is strong enough to cause the striker to override its idle position and ignite the cartridge.

After lifting your finger, spring l) causes trigger and pawl to return to their home positions. The pawl i) does not lock while revolving and so jumps into the next set of teeth. At the same time profile q) enters the by-pass in the sliding member d), brushes up against the flap m), lifts it and becomes free. The flap then closes under spring pressure.

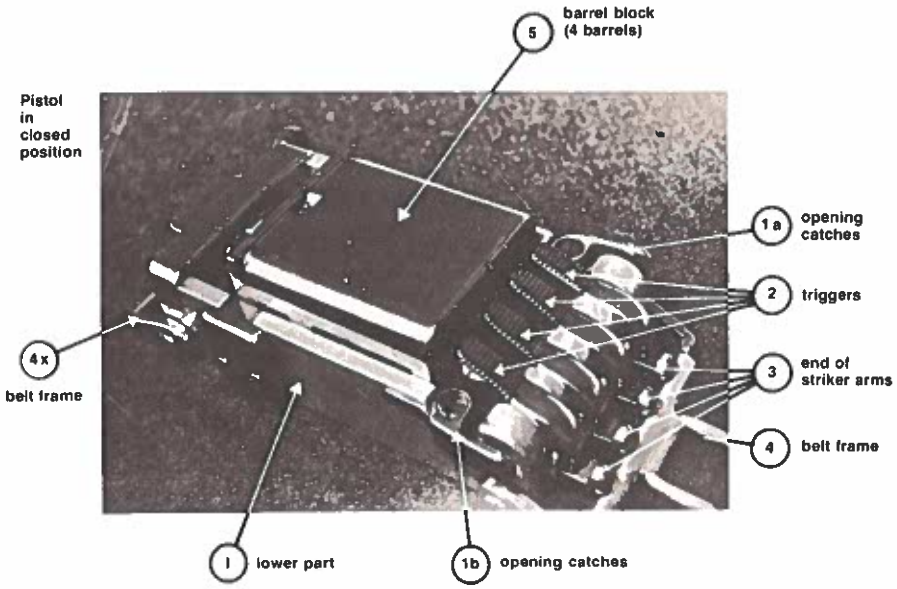
Well, that's the technical side of the invention. I ask you not to get too worked up over the "red tape" of the Patent Office which officially confirmed the designation "Cylinder Revolver." At that time civil servants did not know any better . . .

Now what was the idea behind this invention? It was most certainly not designed to afford party big-wigs last-minute protection, as suspected by the Americans when they marched into Germany in 1945. The patent had already been applied for in May, 1933. And before applying for a patent the inventor usually spends many years working out the details. When the National Socialists assumed supreme power on 24. 3. 1933, very few people in Germany indeed were willing to believe that this regime would soon be spreading terror throughout the land. Such a turn of events was not to be expected, for Hitler and his spokesmen had emphasized time and time again that they were not revolutionists, that they were simply trying to assume power legally. Only after Hitler had banned the KPD (Communist Party) and the SPD (German Socialists) and had forced the smaller parties to disintegrate, was Hitler's NSDAP the sole ruler of the German Reich. On lst December, 1933, the Nazis seized supreme power by operation of the "law for protecting the unity of the Party and state," a law the Hiterites twisted ruthlessly to their own ends.

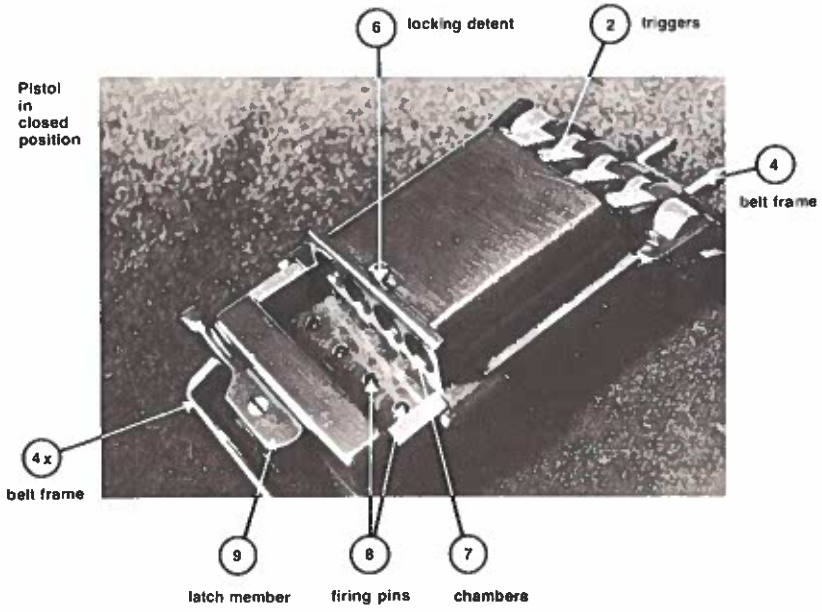
Before Hitler put in his appearance, Germany was in a state of near-chaos; street fighting between the rival parties was on the daily agenda. People were openly beaten up, stabbed or felled by a hail of bullets. Hate went so far that the chosen victim was often presented with a bunch of flowers seconds before being mown into the gutter . . .

Many of those killed were policemen, for the extreme wing parties saw in them the "bondsmen of Justice who helped to oppress the people."

Louis Marquis jr. had experienced the terror of the bloody 1930s. In the preamble he also wrote,



13 *The four-barrelled version with the barrel block in the folded position (buckle face removed.). When catches Ia and Ib are depressed the barrel flies open under spring pressure and is locked in place via the latch member (9).*



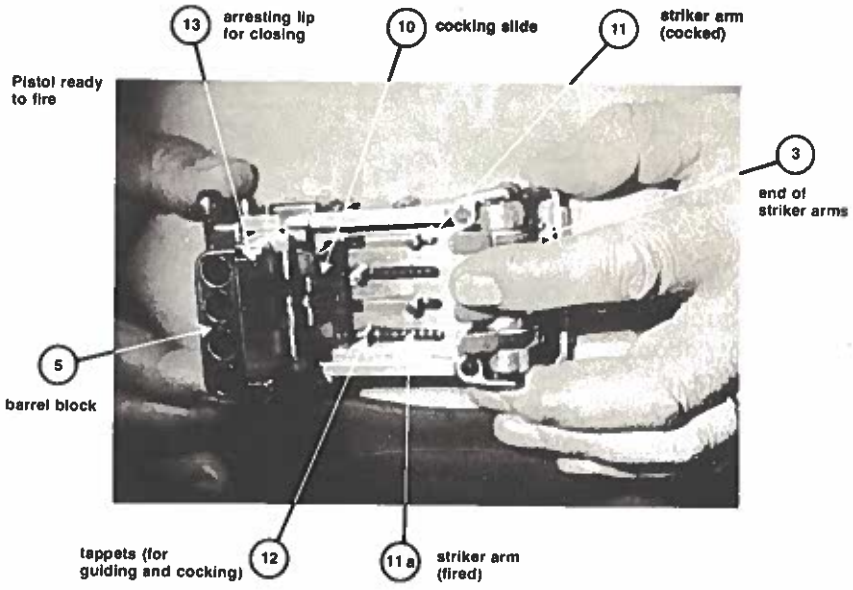
14 *The striker arms (3) are provided with a sloping nose that lifts the firing pins (8). The sprung striker arms are held by the triggers (2) and kept from swivelling out of true by tappets (12) that slide in grooves. When the barrel is pressed flat again, the cocking slide (10) automatically re-tensions the striker arms by engaging the tappets.*

"The main inconvenience with the known types of weapons, be they firearms, knives or truncheons, is that the defender cannot wield them fast enough in the case of a surprise attack. This explains the sad fact that policemen and other agents of the law are particularly subject to being beaten up, stabbed or shot."

So the idea behind the belt buckle pistol was to increase the chance of a constable saving his life. The idea was splendid, but it was not until 1943 that this gadget was debugged of its many teething problems. For what had looked good on the drawing board did not prove itself in daily practice. The pistol was made to fire the 9 mm Flobert – a cartridge decidedly too weak to meet with the requirements. Louis Marquis started on converting his invention to accept the 7.65 mm. During his experiments he finally realized that the cylinder over-complicated the design, so that sealed the fate of the "cylinder revolver in the form of a belt buckle."

In February, 1936, Marquis applied for a new patent and received the number 656595. The weapon was now fitted with a 5–7 cm barrel which could be interchanged with shorter or longer versions. It was designed for 7.65 and 9 mm. The cylinder had been discarded (cf. illustrations 14–20) and, according to the number of barrels, one, two, three or four shots could be fired at once. There is no information

Belt Buckle Pistols


13 arresting lip for closing
10 cocking slide
11 striker arm (cocked)
Pistol ready to fire
3 end of striker arms
5 barrel block
tappets (for guiding and cocking) 12
11a striker arm (fired)

15 *This Marquis fires four 7.65 Browning cartridges (buckle face removed).*

available on the accuracy or the amount of recoil, as this pistol never became a production item. The designer died in September, 1956, so we cannot ask him. His wife and daughter tell us that Herr Marquis was an engineer and hobbyist, and that his death may be ascribed to wounds sustained during the war.

It took many years of tinkering before Marquis successfully converted his "revolver" into a "pistol." However, in 1943 Wuppertal's chief of police informed him that Berlin was interested in his invention. Two agents accompanied him to the capital, where he was requested to construct samples for quantity production. Marquis made about 5 of them. There were never any more, since the Allies bombed the plant in Berlin before production could start. When the Americans reached Wuppertal-Elberfeld they were pretty sure of finding a treasure-trove of these "highly prized" weapons; but, alas, they only found two handmade models despite all efforts.

We were assured that Marquis was glad that his pistol did not go into production. Had he been an enthusiastic follower of the Nazi regime, he would have had his invention appraised long before 1943.

This should be mentioned, for each Marquis pistol was adorned with the SS insignia. For this there is a simple explanation: the samples were made under the juristiction of the state police, the chief of which was Reichsfuehrer-SS Himmler. So it is only natural that these samples were decorated with the SS eagle. There is other evidence that clears Marquis of any Nazi convictions, but such matters are irrelevant here.

International ARMS REVIEW is very interested in hearing from readers who can shed more light on this pistol and its history.

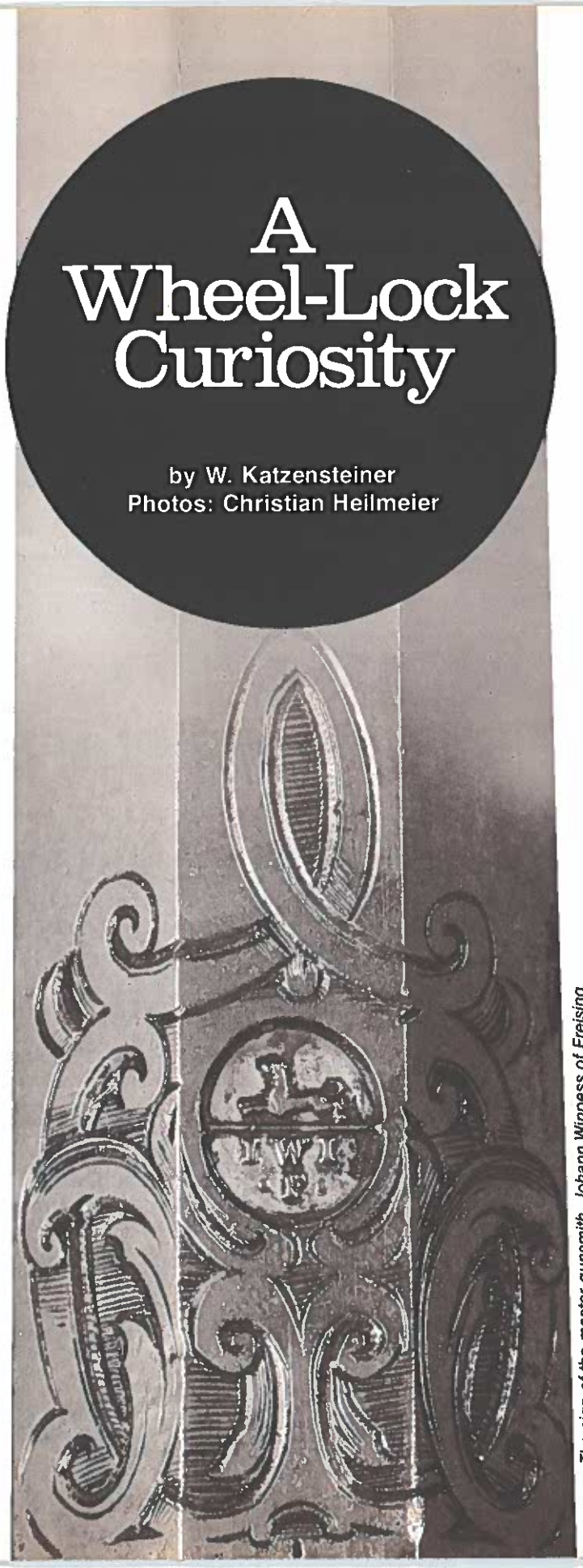
The illustrations 9–12 were kindly provided by Frau Antje Marquis, the illustrations 13–15 and the accompanying comments by Dr.-Ing. Spangenberg.

A Wheel-Lock Curiosity

by W. Katzensteiner
Photos: Christian Heilmeier

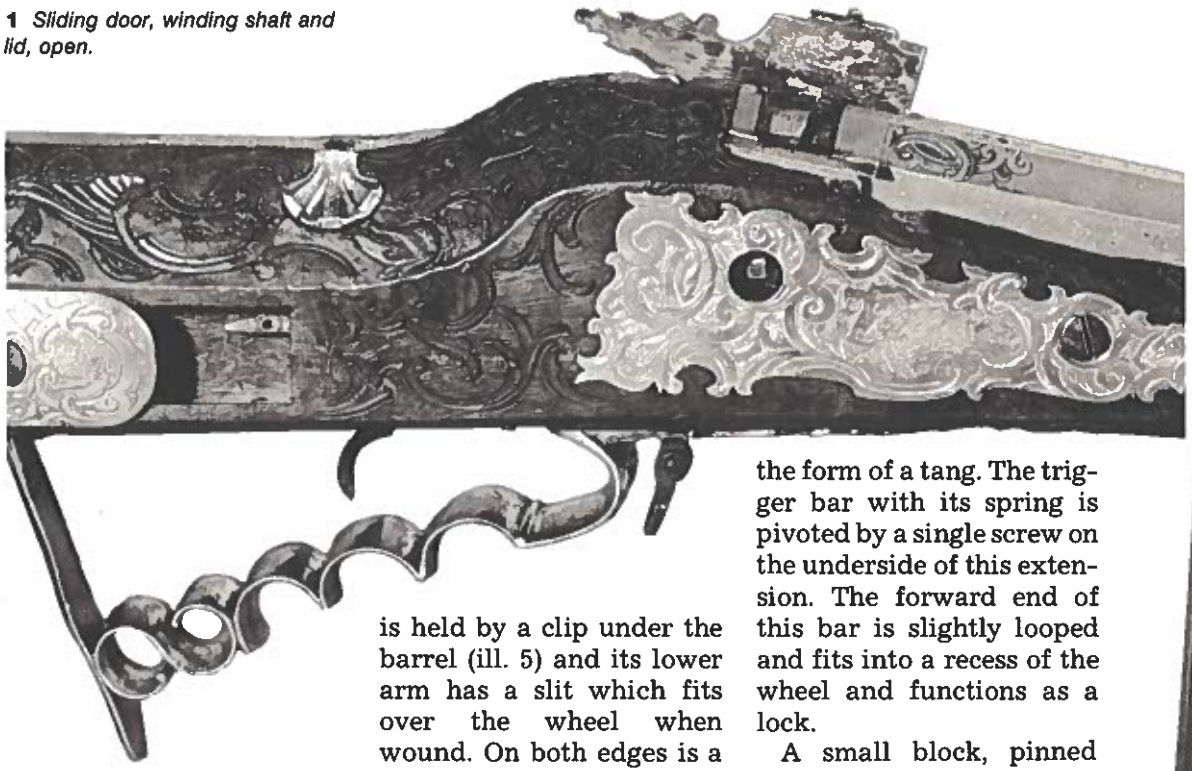
Of the many gun designers, it may well be said that Johann Winpess of Freising (south Germany) was not only shrewd but particularly talented to construct a wheel-lock that must be about the only one of its kind. The carved stock is entwined with tendrils that sometimes end in animals' heads or heads of legendary beasts, there are brass gilt mounts which are beautifully cut and engraved, but no sign of a firing mechanism!

One automatically thinks it is some sort of air gun. By pushing back a sliding door in the stock (see ill. 1) a flat lever with a hole in it is revealed which, in turn, when activated, removes the screw-head covering the wheel-lock winding shaft. A slight turn of the wrench, which I regret is missing, causes a lid to spring open. When the side plate is removed, the hook-and-spring linkage that operates the lid, and also the dummy screw on its swivel, can be seen. (ill. 3). Below the action, just before the trigger guard, is a lever with a lanyard swivel-head that is attached to the cock (the hammer-like device that holds the piece of iron pyrites). When this lever is pulled downwards the cock is forced into the firing position. By knocking out the swivel-pin, the trigger guard and hair-trigger lock mechanism can be drawn out. The lever that connects up with the cock can now be unscrewed, with a lefthand thread. The barrel, which is held in place by the screws that hold the under-barrel ramrod rings, can be released and lifted away from the woodwork with the complete wheel mechanism



The sign of the master gunsmith, Johann Winpess of Freising

1 *Sliding door, winding shaft and lid, open.*



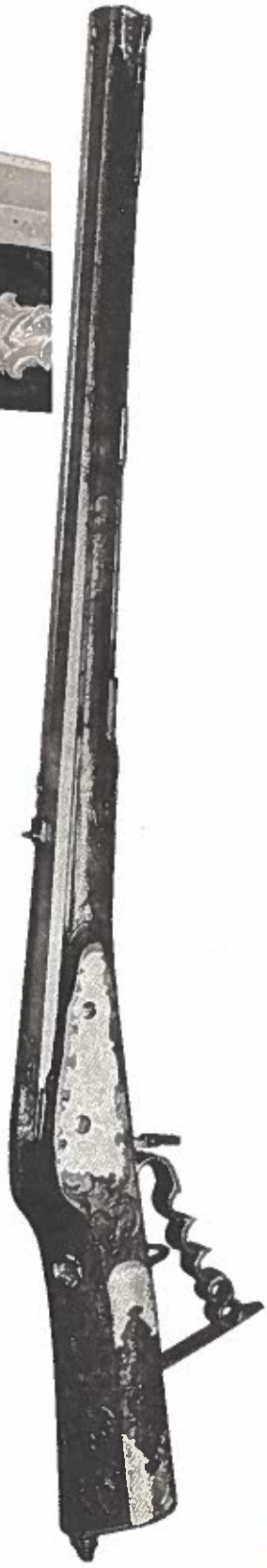
by simply pulling the barrel forward so as to disengage the holding hooks. The lock mechanism is particularly complicated. The V-spring is held by a clip under the barrel (ill. 5) and its lower arm has a slit which fits over the wheel when wound. On both edges is a three-link chain, the upper ends of which are fastened to the axle of the wheel. The wheel bearings are screwed vertically on to the receiver which, rearwards, takes on the form of a tang. The trigger bar with its spring is pivoted by a single screw on the underside of this extension. The forward end of this bar is slightly looped and fits into a recess of the wheel and functions as a lock.

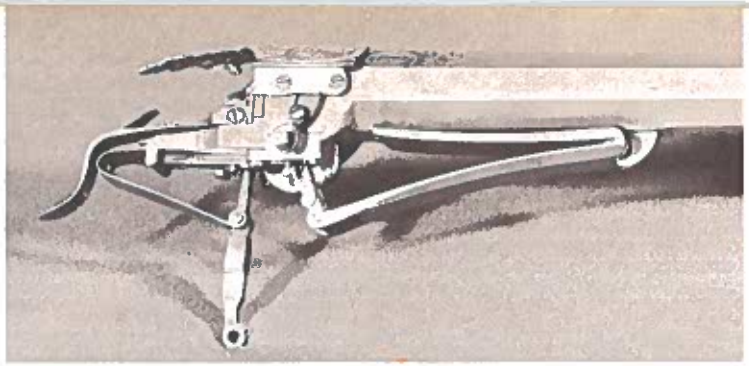
A small block, pinned and screwed to the back of the receiver, is provided with a guide hole for the cock-actuating lever and also accepts the stock bolt. The arms of the trigger-sear

2 *The cock in its guides, inside the chamber.*

3 *Side plate removed, dummy screw on swivel.*

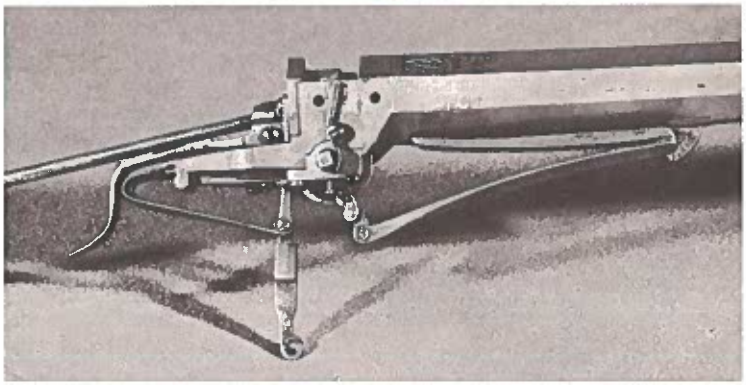
4 *The 'pan' (chamber), cock withdrawn.*





5

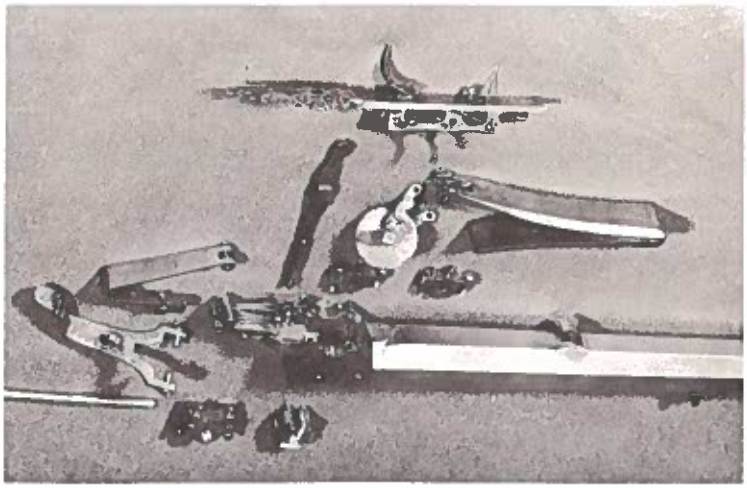
5 *Barrel assembly and action.*



6

6 *As above without lid, notice stock bolt.*

7 *Cock, block, stock bolt, barrel assembly with tang, trigger bar and spring (screwed under tang), trigger-sear fork with sear, V-spring, wheel with two chains, the two wheel bearings (above), Cock-actuating (pull-down) lever, spring, hair-trigger assembly.*



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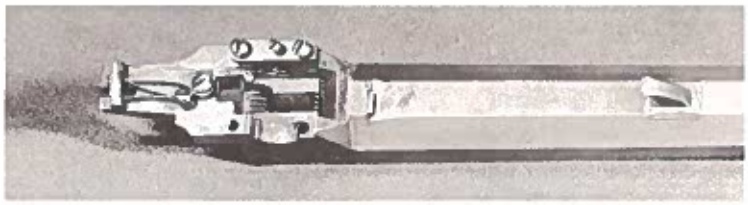
8 *Chamber (seen from below) with one wheel bearing. The trigger bar and spring are screwed under the tang. The sear of the trigger fork engages the trigger bar through the visible gap.*



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9 *Coat of arms of Herr Innozenz Völkl (1761–1769) of Weihenstephan.*

9

A Wheel-Lock Curiosity

A contribution to wheel-lock taxonomy

fork are pivoted on both sides of this block. The spring for the cock-actuating lever is situated under the tang and fastened by a screw on the left. The stock bolt prevents the trigger-sear fork from moving upwards, however, the flat spring on the back of the trigger-sear fork allows some leeway. The sear blocks the trigger bar so that its nose is forced into a recess on the wheel. The cock, loosely mounted in its guides, is fitted with a deep and shallow heel on its rear side, so that, by activating the pull-down lever, its jaws with the iron pyrites are pressed hard, or not so hard on the wheel. The walls of the chamber or "pan" are slightly sloping, its floor having been filed out to allow space for the rim of the three-grooved wheel to show through from beneath. It is 27 mm in diameter and fits into this floor space nearly perfectly. The flash hole has been drilled horizontally into the tail screw of the barrel.

The barrel is octagonal, has 7 grooves and fires a ball of 12 mm. The metal rear sight folds forward and the fore sight has a copper bead

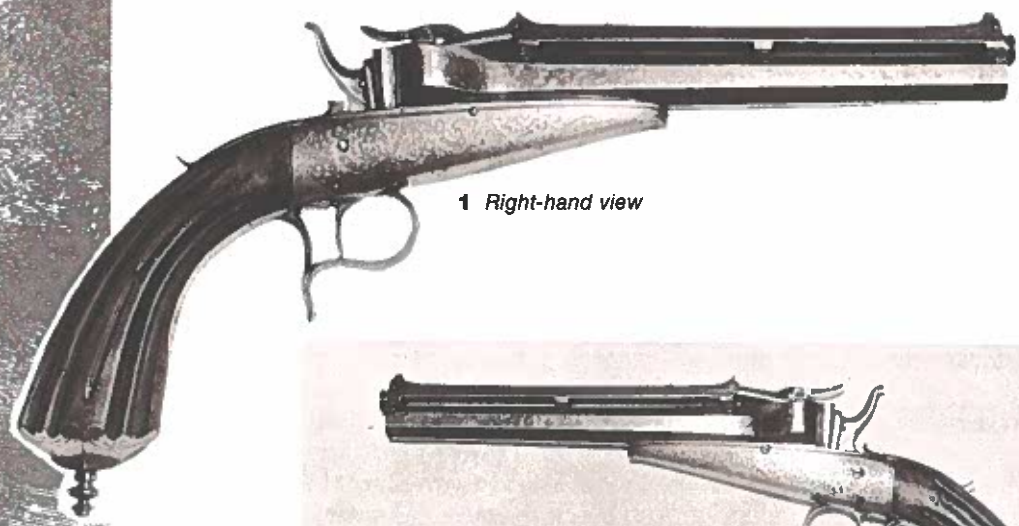
The inscription on the top edge of the barrel is, "Joh. Winpess in Freising." In addition there is stamped the sign of the master gunsmith. The stock bolt has 4 duties: a) to hold the barrel assembly in place, b) to block the cock-actuating lever, c) to prevent the trigger-sear fork from rising, and d) to serve as a ram head on the butt plate. The wheel is wound up with the wrench. When the trigger bar has engaged the stock bolt automatically forces the sear over the bar. The pull-down lever presses the jaws of the cock down on the wheel. Upon pulling the trigger a finger mounted on the top of the trigger assembly (ill. 7) brushes against the trigger-sear fork which, in turn, rises together with the sear. The V-spring now opens with a jerk and whirls the serrated wheel, forcing the trigger bar to one side. As the cock holding the iron pyrites is in the forward position and is resting on the wheel, sparks shower into the powder in the "pan" which then ignites the main charge in the barrel.

The coat of arms (ill. 9) let into the stock has been identified as belonging to Herr Innozenz Völkl (1761–1769), an abbot from Weihenstephan. So we now know when this weapon was made. However, it is interesting to note that this wheel-lock must also have been fired during the last century; for under the brass gilt side-plate mount I found a note written in pencil: This rifle was repaired in Merano (Italy) anno Domini 1865.

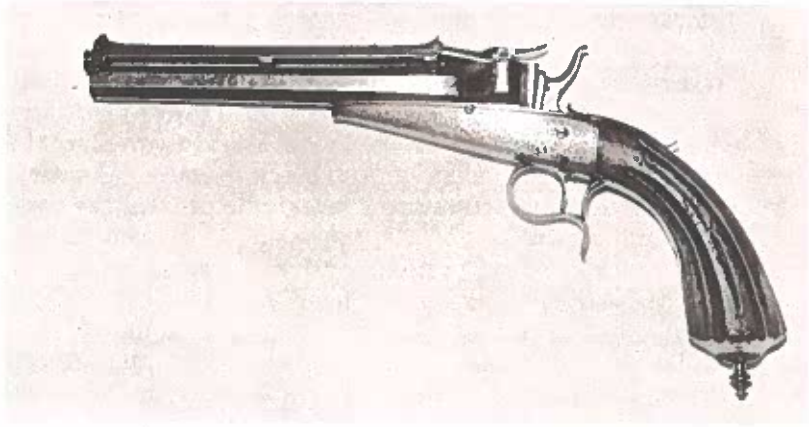
This glass-painting by Leonard Gauthier and Lemard (Troyes) shows Louis XIII, a French king, shouldering a wheel-lock musket while out hunting.

Text and Photos: Gerd Hein

Collette's



1 *Right-hand view*



2 *Left-hand view; chamber and hammer in home positions.*

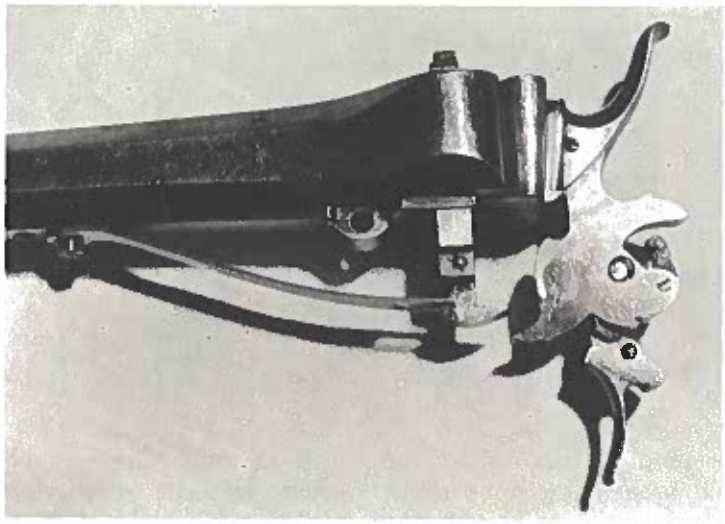
Victor Collette was a gunsmith in Liège (Belgium) from 1850 till 1870.
The gravity loaders were his chief passion, which he calles, "à glissière". Although this system was well advanced for that period of time, the gravity loaders still had their shortcomings.

Gravity Loaders

The Collette pistols were commonly produced in calibres from 10 mm to 13 mm and in various barrel lengths. One of his pistols has a barrel and magazine of about 10 cm in length. The magazine holds 6 shots of calibre 12.5 mm. The stock is of walnut, rounded, checkered; manufacture about 1853.

Collette pistols were also made without magazines. The shots were placed by hand in the chamber. The butt plate is smooth with a minimum of engraving. The calibre is 12 mm, and the pistol dates back to about 1852.

Collette also went in for presentation models. One of these is displayed at the Arms Museum of Liège. Grooves have been let into the edges of the barrel which run from the base of the chamber and stop just before the muzzle. The bulge of the chamber and the muzzle have been touched up with gold. The grip is of ebony with a carved and checkered surface. Otherwise this presentation model is identical to Collette's standard models. All the weapons have an engraved receiver. They are also known as "gravity feed pistols".



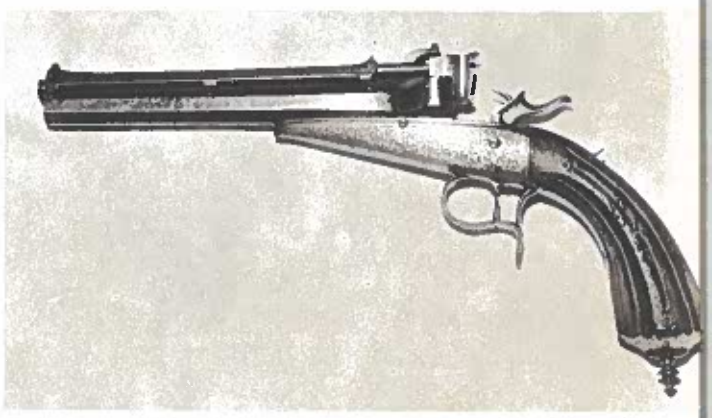
3 *Flat spring holds the chamber in home position via link column. Hammer is driven forward by V spring (not illustrated). Trigger not engaged.*

General description

No changes appear to have been made since original manufacture. The pistol is 37 cm long and 19 cm high. The octagonal barrel is 214 mm and has a 12-groove rifling. The magazine is attached to the barrel via 6 screws (3 on each side). It is perforated to allow a visual check. The calibre is 10 mm. It fired a spitzer bullet with its own ignition system and propellant. Internally, the chamber is about 190 mm. The loading arm is held horizontally by a flat spring.

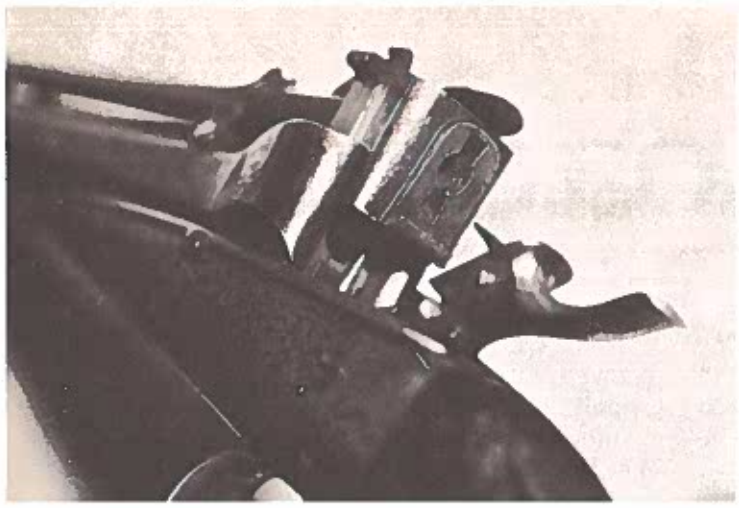
The butt plate, trigger guard and receiver have been engraved. Butt plate, trigger, trigger guard and receiver are polished; whereas chamber, hammer and loading arm are matte.

The barrel and the sliding safety catch have a highly polished brown finishing. The grip is of walnut. The sights are placed on the stationary parts of the magazine, the distance between rear and front sights being about 180 mm. The safety device slides in front of the hammer.

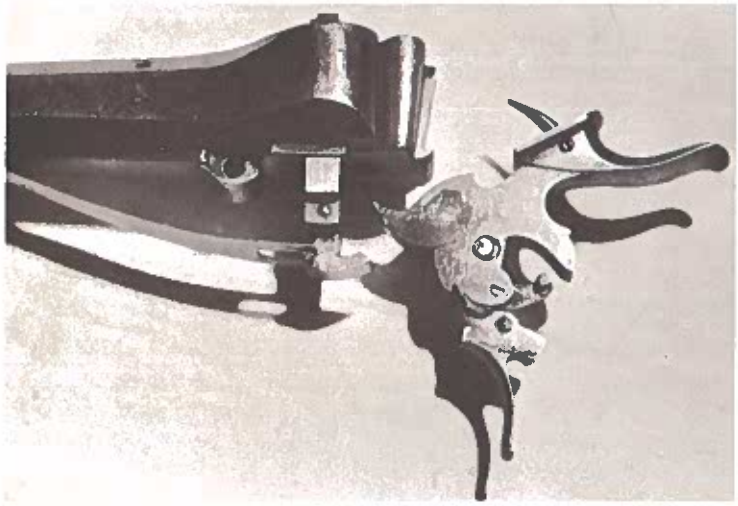


4a *Chamber in line with the tube magazine. The next shot slides in when the pistol is held upright, hence "gravity loader."*

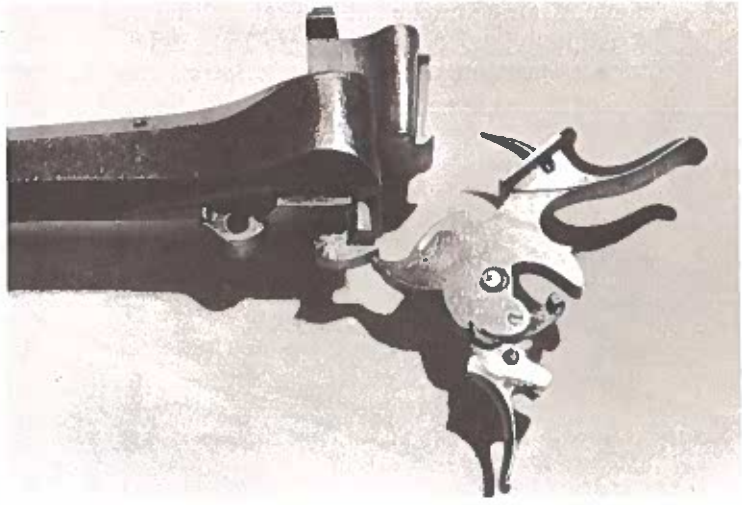
4b



5a



4c



5b

4b *Rear view. Notice the chamber guide and the thorn-type wedge.*

4c *Hammer in half-cock loading position. Trigger engaged.*

5a *Ready for business.*

5b *Hammer in fully cocked position. The toe of the chamber column has overridden the foot of the hammer (in the high position) and is pulled down to home position by flat spring.*

Loading

Uncock the hammer (illus. 1), raise the plug of the tube magazine (illus. 7) and slide down 15 shots, their points facing the muzzle. Close magazine. Now half cock the hammer (ease the hammer back until it clicks once) and the magazine and chamber will be brought into alignment (illus. 4a). Hold the pistol vertically and the first shot will enter the chamber. In case of a stoppage the shot must be forced into the chamber with the loading arm. The hammer is next fully cocked (pull back to the second click) and the chamber slides into alignment with the barrel. The gravity loader is now ready for business (illus. 5a) and the trigger can be actuated in the normal fashion. The propellant is ignited by the spike on the hammer.

To carry the pistol loaded, the safety catch is swung down to engage the spike of the hammer (illus. 6).

What is one to do when there is a dud in the chamber? The only thing to do in such a case is to open the magazine and tip out the reserve shots, half cock the hammer and tip out the dud as well. There is no other way of remedying such a stoppage.

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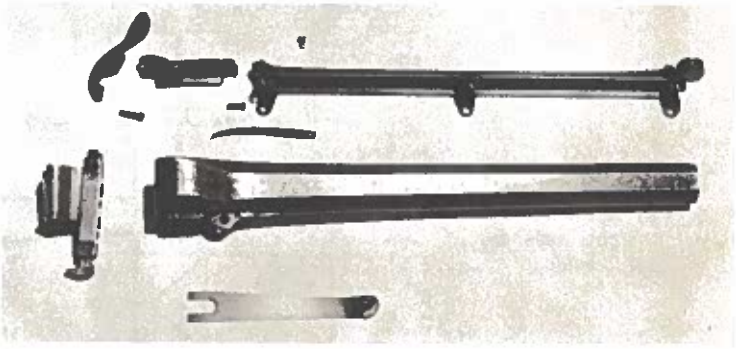


9

6 *Safety applied.*

7 *Muzzle and magazine opening. Plug hinged back.*

8 *Stripped into main parts.*

9 *Barrel, chamber and magazine.*

Proof marks

There are no visible proof or manufacturer's marks on the external surfaces. However, marks will be found under the barrel, the part covered by the receiver.

Belgian proof marks (black powder) for all weapons made and proofed in Belgium.

Official supplementary mark which had to be struck in addition to the main mark (from 1852).

Private proof mark

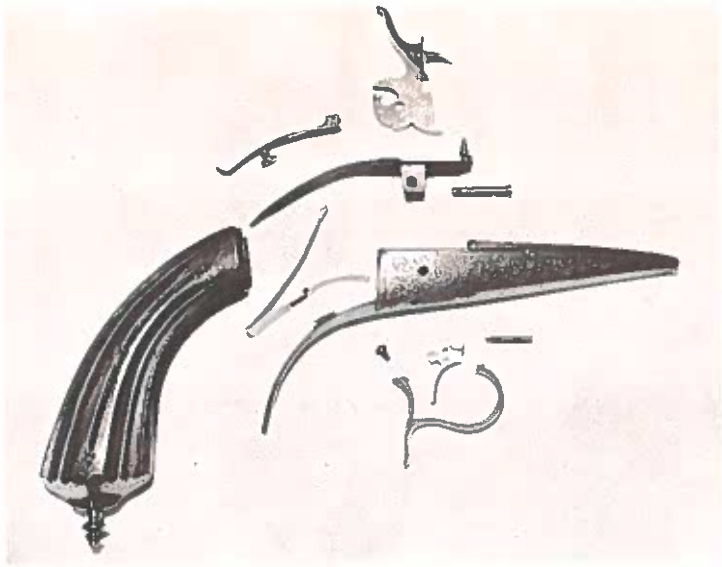
VC 447 Victor Collette's production number.

How the gravity loader works

The chamber is held in the firing (lower or home) position by a flat spring under the barrel (illus. 3). In illustration 4b the bottom lip of the chamber can be seen which, when held by the hammer, prevents an upward movement. The foot of the hammer underlies the toe pivoted to the chamber column (illus. 3). The slot in the flat spring keeps this toe from getting out of true. The moving part of the magazine is pressed downwards by a small spring. The loading arm is fastened in the middle with a screw, thus lying in a horizontal position with its broad end on the chamber.

By half cocking, the foot of the hammer lifts the toe, attached to the column of the chamber, high enough for the chamber to align with the tube magazine. The trigger nose locks in the first hammer detent and holds the hammer (and chamber) in place. The moving part of the magazine is also lifted, allowing the next shot to slip into the chamber (illus. 4c). The horizontally positioned

10 *Trigger mechanism.*



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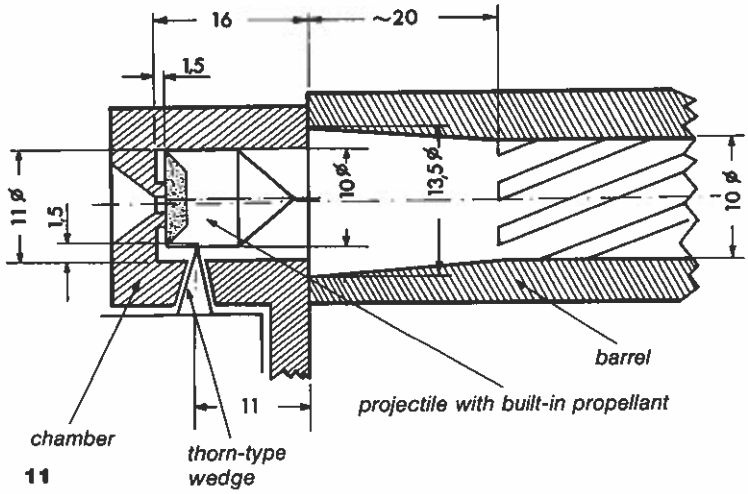
11 *Barrel and chamber assembly. Not to scale.*



11

loading arm does not hamper this function.

By thumbing the hammer back still further the chamber starts to rise again. The flat spring is drawn tight under the barrel and, owing to increased tension, the toe slips deeper into the slot (of the spring). When it has gone far enough the toe disengages from the rising foot of the hammer and is snapped back with the loaded chamber into the home (lower) position by the flat spring. See illustration 5b. The loading arm likewise returns to its home position. Finally, the hammer engages in the second detent and is fully cocked. When actuating the trigger the hammer is released and forced forward via the hammer spring (illus. 8 and 10). The foot of the falling hammer momentarily brushes the toe back into the slot of the flat spring, thus resuming its original underlying position. At the same time the hammer closes over the rearward lip of the chamber. The cycle has been completed. See illustration 3.

Stripping

Separating the barrel from the receiver (illus. 8) is simple. Cock the hammer and apply the safety. Remove the two marked screws (illus. 5a) and lift barrel from receiver. The tube magazine can be taken down from the barrel after removing 6 screws. The magazine can be stripped further if required. (In illus. 9 the loading arm is falsely positioned). Remove the flat spring under the barrel and slide out the chamber. In order to take the receiver apart, first remove the wood screws from the stock. As the hammer pin also holds down the top plate (illus. 10) care should be taken that this plate does not shoot up when the pin is removed. Under the tension of the hammer spring this can easily happen once the pin has been screwed out. Hold the plate down with your hand while removing the hammer pin. This precaution also protects the thread of the hammer pin. The trigger guard is held by a screw from within the receiver. Remove this and twist the guard on its front axis to wind it out of the receiver. The trigger is pivoted by a through-running bolt. The safety catch can be removed from the top plate.

To assemble simply reverse the procedure. Difficulty will arise with the trigger mechanism. Position V spring and top plate and dangle the hammer stirrup (marked in illus. 10)

until it engages in the spring. This will mean fumbling around quite a bit until everything lines up. When the three parts interconnect property, be quick about putting the screws in – for this apple-pie order won't last long!

Ammunition

Spitzer bullets are used with built-in ignition and propellant (no cartridge case!) and there are no lubrication grooves.

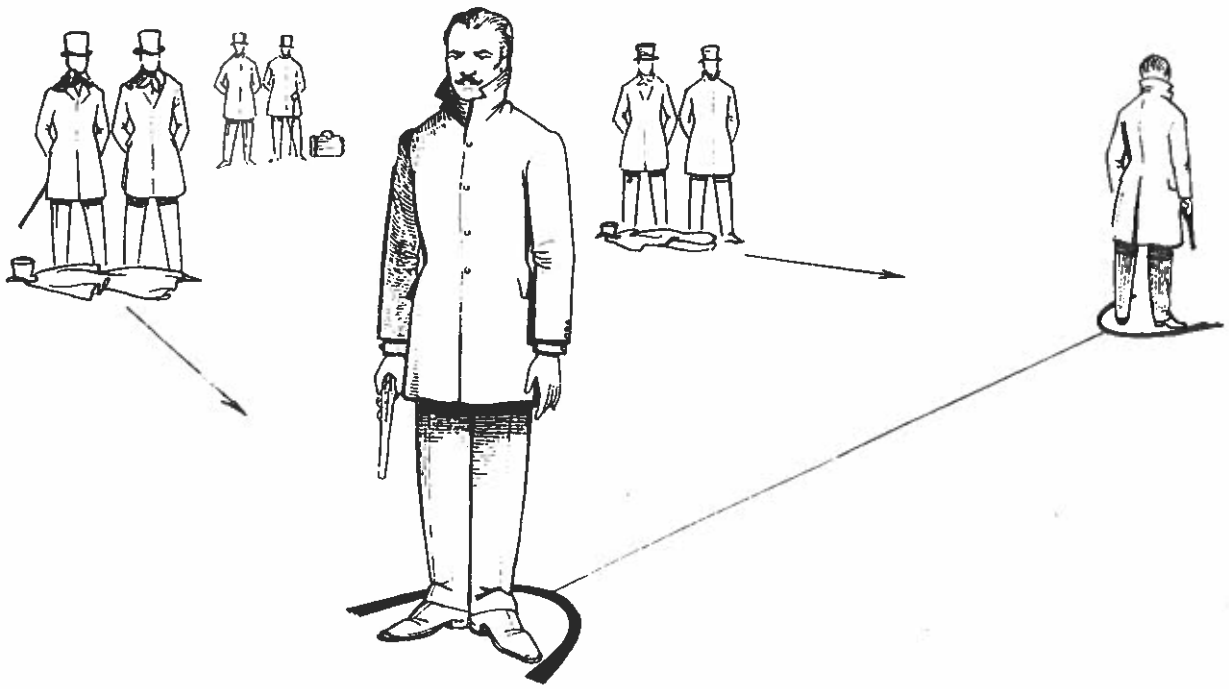
A technical subtlety

The very first time I handled the pistol I noticed the thorn-type wedge under the chamber. What was its function? It was indeed strange that the chamber had a opening to accept this "foreign body." It could not have anything to do with ignition, that would have rendered the hammer superfluous.

I came across the solution by measuring the chamber cavity (illus. 11). Its diameter measured 11 mm, but that of the bullet was only 10 mm. This extra space of 1 mm is necessary, otherwise the shot could not fall freely into the chamber under gravitational pull. When the loaded chamber is lowered to the firing position the opening passes over the stationary wedge and the bullet is literally harpooned and forced tightly against the roof of the chamber. The bullet now offers resistance to the falling hammer, necessary for ignition. If the bullet were not held tightly it would simply be thrown into the 13.5 mm mouth of the barrel, by the momentum of the falling hammer, without being ignited.

This gravity loader might have been practical for sporting events, but not for self-defence. Bearing in mind the weak propellant and the high degree of gas escape, the Collette pistols cannot have had much power. I want to place this pistol into the saloon-pistol category, as it also strongly resembles this class of pistol. It is impossible to say whether this pistol was functionally reliable. Nonetheless, I am sure it was useless as a fighting weapon, as every step of the loading procedure had to be watched most carefully if one did not want to experience a hollow "click."

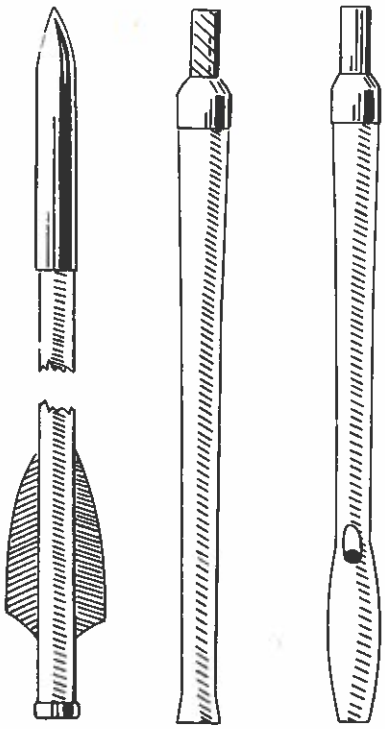
Still, in all fairness, it and its ammunition were of precocious design for the year 1850.



Duelling with pistols at a set distance.

The Crossbow as a

This hobby of mine must have begun taking shape the moment I showed my son suits of armour, swords and bows that were being displayed in a museum; explaining to him that for every weapon a counter-weapon is made. We traipsed from showcase to showcase and discovered quite a number of different types of crossbow. Some of them were powerful instruments with steel bows that could only be spanned with the aid of a windlass or a cranequin. Valuable pieces were decorated with marquetry work and fine engravings.

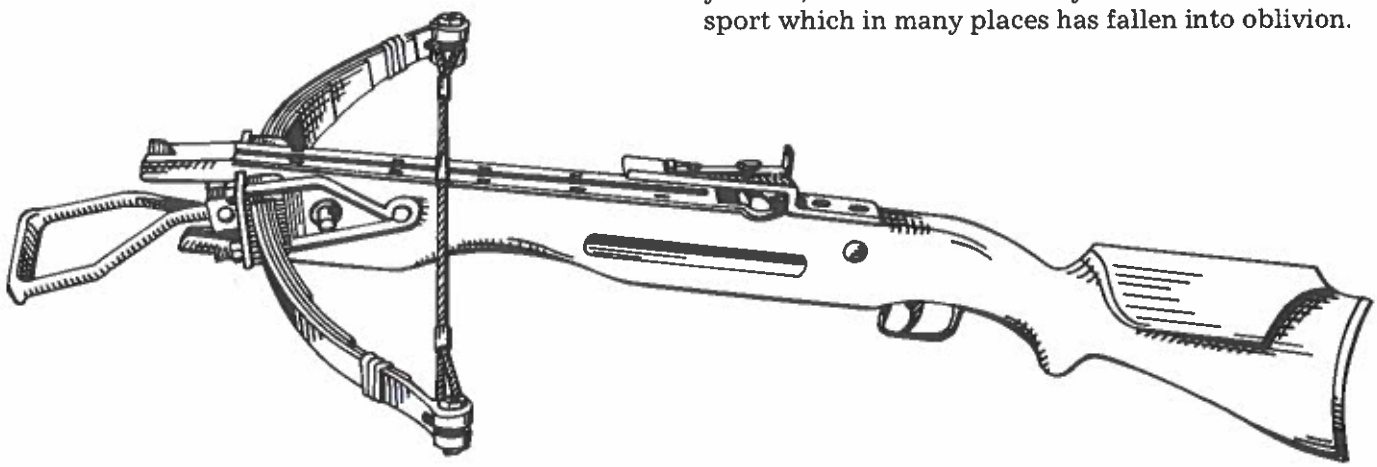


As I have knowledge of weapons from my army days, I was naturally interested in their penetrating power and ballistic performance. Unfortunately, there were no facts to be dug up anywhere. Crossbows that are housed in museums can hardly be used today, for over the centuries the materials have dried out, if not fallen into decay. This gave me the idea of finding an interesting model and constructing my own. In Fig. 1 you can see that I utilized an old car spring, made up of 6 pieces and 85 cm long, for the steel bow. I doubt very much whether the original drop forged tapered bows can be easily made today. By adjusting the locking nuts that hold the bow I can shorten or lengthen the pull of the cord between 25 and 30 cm at will. To prevent accidents I mounted a strong metal guard over the catch. When tilting my crossbow at about 45 degrees I can fire a 40 cm quarrel with a twisted steel tip (calibre 12 mm) some 200 meters into the air. With a quarrel made of light metal tubing (calibre 9 mm) I even managed the 250 m line. The feathered quarrels were remarkably steady in flight and went down deep into the earth.

Spanning a powerful crossbow is indeed a brawny business and tends to be exhausting if you have not had a good breakfast. In some parts of Germany the old tradition of shooting down a wooden eagle, crowned in kingly fashion and perched on a high mast, is still very much alive.

Since there is nothing like that where I live, I set about pumping up coloured balloons and tied them at various heights. For target practice in the horizontal, I removed one of the layers of the bow as it was not only too powerful but also too tiring to load. So you see, in a roundabout way I had stumbled on a sport which in many places has fallen into oblivion.

TEXT AND DRAWINGS BY HEINZ MEYER



Sporting Weapon

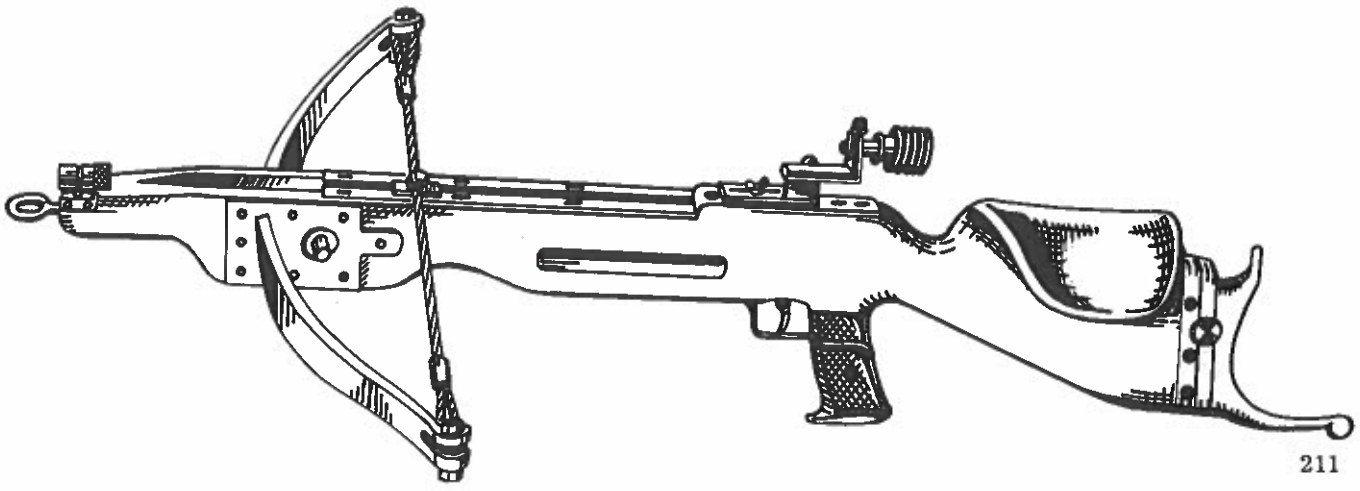
At that time crossbows could not be bought in Germany commercially.

It was not until 1963 that I heard of the so-called match crossbows that are made in Switzerland. During that year, the 4th European championships took place in Romanshorn (Lake Constance/Switzerland) in which 6 countries participated. The headquarters of the Cross-Bow Union, an international organisation, is, of course, also in Switzerland. Where else could it be!? The Swiss are the blue-blood aficionados of this sport, they are so keen on it that modern target ranges for crossbows are commonplace. Firing is done standing (free hand) or kneeling at 30 meters. The target is 20 cm in diameter and has 10 rings spaced 10 mm from each other. The 10-ring measures 20 mm and the 9-ring measures 40 mm in diameter. And so it goes on. At that time the Swiss had about 2700 club members. Over the years the sons of Wilhelm Tell have put in a lot of thought and practice to perfect the crossbow. Their match crossbow (Fig. 2) is the outcome of this development. The steel cord is snapproof and 68 cm long. The short, pre-formed bow produces a tensional force of about 130 kg and spanning can only be carried out with a rack. To ensure the smoothest release possible the length of pull is limited to about 15 cm.

The Swiss weapon has been designed so that the quarrel races along an open carriageway, pushed by a stop mounted in a slide or rail. Before the quarrel reaches the bow it rises into the air just high enough to detach itself from the propelling cord. The stock is about 90 cm and is often fitted with an adjustable pad. According to the position of the diopter the line of sight measures between 65 and 72 cm. The short pull has been designed to avoid fatigue of material as far as possible. The catch automatically engages the cord and, when fired, drops flat. The quarrels of the match crossbow are only about 13 to 15 cm long. Usually they are not feathered, but are equipped with a metal tip mounted on a coarse thread. The quarrels are shot into a lead plate which lies under the target sheet, from which they can be easily removed by a twist to the left. The hole in the target sheet then has a wadcutter appearance. Recently, an "air-stabilized" quarrel has been put through its paces, and it seems to have proved itself. A lateral slot has been cut through the rear end which improves aerodynamic performance. Air enters these side holes and leaves through an exit port in the rear. By cutting oblique air holes the quarrel can be made to spin like a bullet.

The match crossbow has been specially made for target shooting, its accuracy is of sole importance. Distance and penetration are of no interest at all. Although it may be surprising to some, crossbowing has nothing to do with archery (long bow). The crossbow man holds his weapon like a rifle and aims through micrometer receiver sights and globe front sights, which is by no means the case with the archer. Still, it is amazing that today's sportsmen, aided by modern technology, have had the interest and endurance to refurbish relics of the Middle Ages and turn them into instruments of astounding accuracy.

Crossbowing is an interesting sport, but unfortunately prices for equipment are high. In many countries crossbows are not commercially made and the Swiss models cost 250 US dollars, or even more. Let us hope manufacturers elsewhere will start producing crossbows at more reasonable prices.



The Introduction of Firearms to Europe

Anyone who has grappled with that part of history dealing with Europe's first experience with firearms will have made the surprising discovery that gunpowder has been known for ages, but that the Europeans did not use it for war until the 13th century. Why were they so slow on the uptake? Christian Schenk, the author of this article, essays an explanation. Not only does he analyse those early European attempts at gunnery, he also tells us what exactly retarded progress in that period.

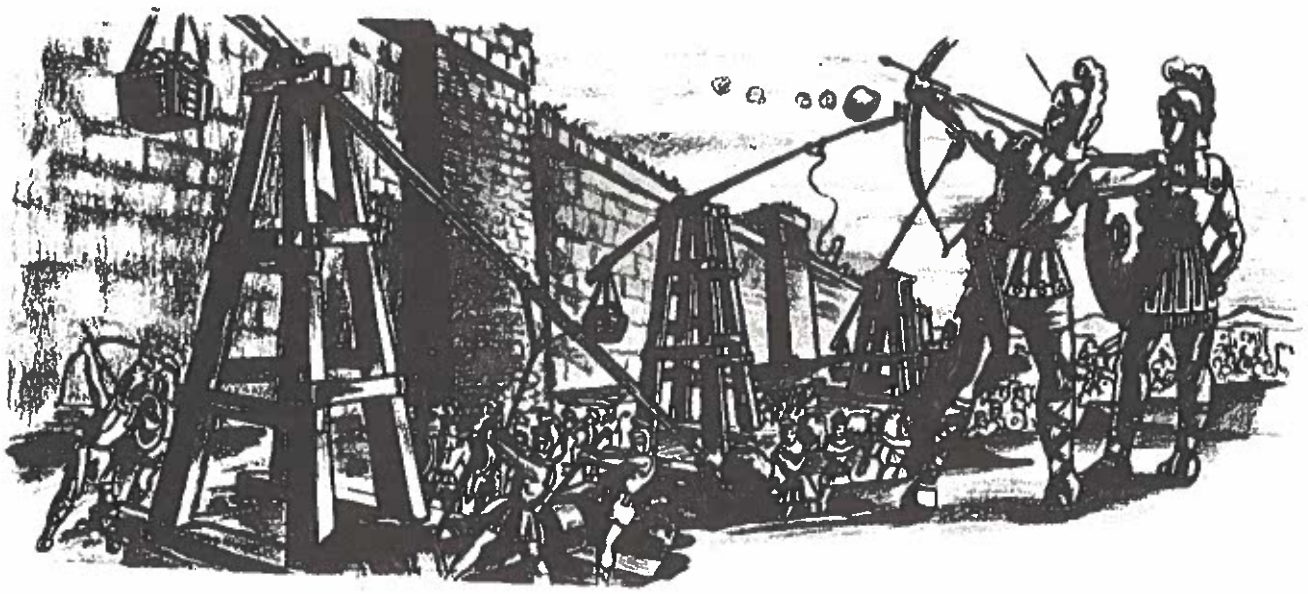
Gunpowder was invented in the lst century A. D. Long before this date, however, burning objects were lobbed into enemy camps with giant catapults and archers shot burning arrows. In the 4th century B. C., Aeneas, a Greek writer on military affairs, describes this incendiary agent:

"To make a fire which cannot be extinguished you take pitch, sulphur, oakum, grains of incense, and resinlike wood for the flares, and make balls from these ingredients."

It is known that firearms were used in China when the feudal lords were fighting one another, or fighting against the Chou Dynasty at the same time. A document dated 618 B. C. speaks of a big calibre firearm inscribed with, "I hurl death at traitors and destruction at insurrection."

Even the Chinese Wall, which was built at the command of Emperor Shi Huang Ti (221–210 B. C.), allows conclusions to be drawn about firearms, as the embrasures are equipped with metal swivel rings for retarding the jump of recoiling cannon.

Reliable information on early incendiary agents has been passed down to us by Kallinikos, the Greek from Heliopolis, who, during the siege of Constantinople, supplied Emperor Constantinus IV with the formula for making Greek Fire. This Greek Fire was successfully employed when defending the city against the Arabs – who had conquered Syria and Palestine and destroyed Carthage. The original incendiary agent consisted of sulphur, oakum, resinous wood, pitch, etc. and was designed from the word go as an instrument of war. Later on this mixture was



1 *Besieging a town in the 12th century, B.C.*

enhanced with caustic lime and petroleum. It burnt on water, and was often called sea fire.

Greek fire was hurled at the enemy in balls or squirted from jets that remind us today of our modern flame throwers. The formulas were continually being updated, and incendiary compositions were used for sea fighting until the 13th century. Graecus (9th century), speaks of an incendiary agent made from sulphur, tartar, an adhesive substance, pitch, saltpeter and rubber; whereas Valturius describes a composition made up of charcoal, saltpeter, sulphur, pitch, "burning water," myrrh and camphor. Yet another incendiary agent consisted of pulverized sulphur, tartar, table salt and old wine. Marcus Graecus must also have known how to produce gunpowder, for he described a formula consisting of, among other things, 6 parts of saltpeter, 2 parts of sulphur, and 2 parts of charcoal.

Firearms Revolutionize The Tactics Of War

Gunpowder is used as a propellant in the Orient
The beginnings of knighthood in Europe

Gunpowder was known in the Orient before it came to Europe. The Arabs conquered Mecca with firearms, and this new, dreadful weapon probably helped more in spreading the new religion than the sword did. The Arabs imported their skills in gunpowder mixing from India, and in their language call saltpeter, "thely sini" – Indian or Chinese tea. The Persians say, "nemek chini," which means the same.

The Orientals created a horrible weapon which sealed the fate of Heinrich II and his gallant knights at the Battle of Liegnitz on April 9, 1241. Knights in steel armour faced cannon, and were beaten. Heinrich II was killed during this battle. At that time gunpowder and its effectiveness was already known in Europe, but this secret was jealously guarded by the alchemists and by the monks in the seclusion of their cells. Furthermore, chivalry did not permit a knight to lower himself to such (cowardly) means of fighting. A knight worthy of his salt relied upon his physical strength, his courage, and his skill with the lance. For all that, firearms swiftly put an end to knighthood, helped democratize the European armies, and eventually brought about new tactics in the field.

To be able to appreciate just how revolutionary firearms were in Europe, one must have a better understanding of the traditions of knighthood.

Let us start at the very beginning when homo sapiens arrived naked and defenceless in this world of ours.

The animals had claws, sharp teeth, and could run very fast. Primitive man had to use the only endowment he had – his wits – to survive in the kingdom of the beasts. He had no other alternative than to arm himself as best he could. Physical strength and courage were decisive factors if the family or tribe were to exist. The strongest and most courageous fighter became the leader or king of his group. Early man was armed with a short spear and a sword, later on with a

battle-axe. The materials and techniques used for making weapons naturally improved with the degree of development. However, personal courage and strength remained the vital factor when fighting wars.

The Norman Influence On War And Tactics

Conquests in Europe, Asia and America
The concept of feudalism determines the nature of further wars

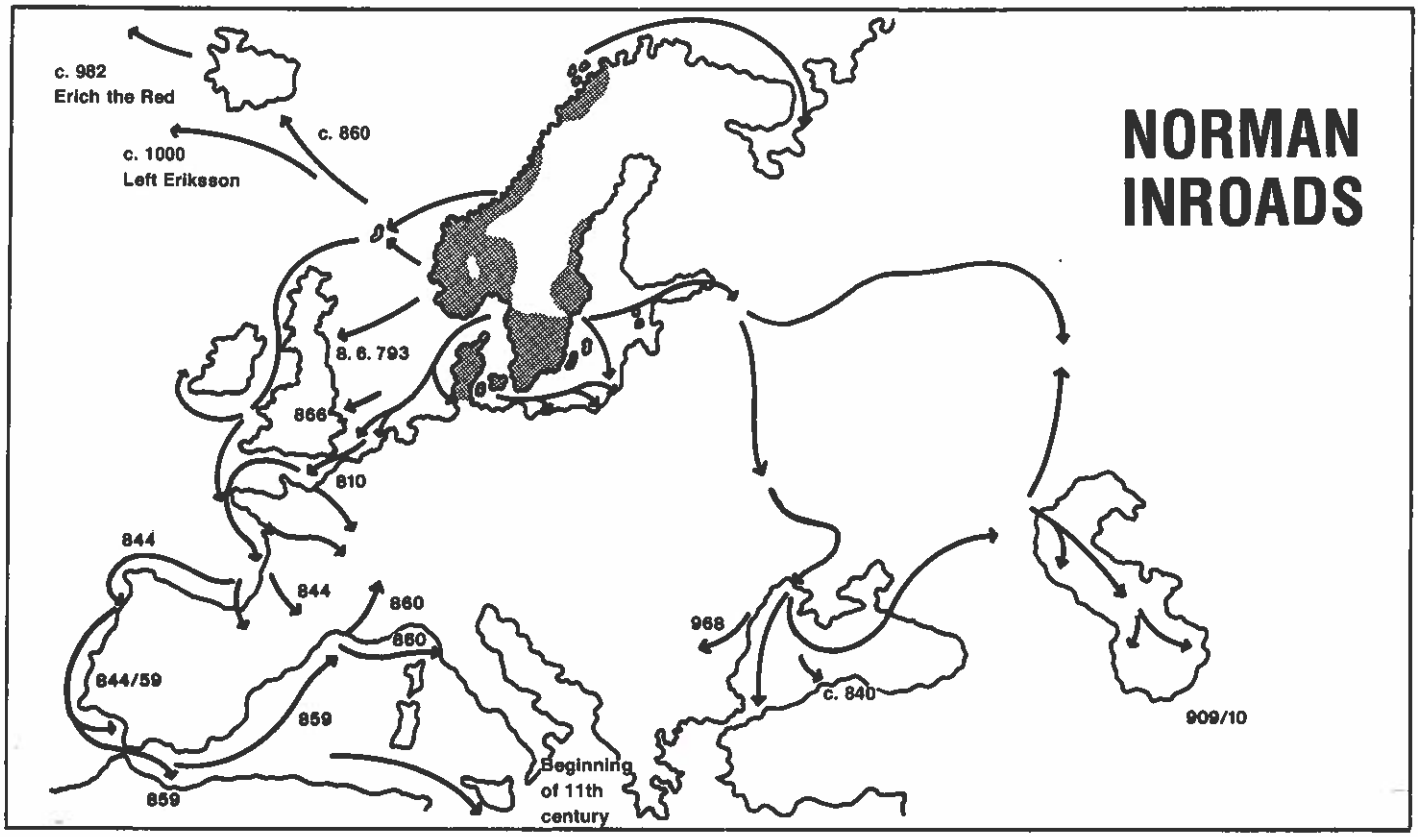
European knighthood was strongly influenced by the presence of the Normans who as pirates, conquerors and founders of new states plagued the coasts of Europe from the 8th century onwards. It was not long before they were respected as fearless warriors. The Normans were quick to convert the war techniques of their enemies to their own use when they deemed them to be improvements on the methods they had brought from home.

The Normans appeared in West Europe for the first time in 787, and became famous for their bloody raid on the Lindesfarne cloister in north-east England, in 793. They came in small groups in fast boats, and returned home during the winter. In later years these combat groups grew larger and they then remained in their operational areas throughout the year.

The Normans set up bases in the north of Scotland, on the Isle of Man and in Ireland, from where they made raids against England and powerful France. Known as the "Norman misery," their great army passed through these countries, plundering and burning everything that stood in their way.

Between 881 and 882 the Normans conquered Neuss, Cologne, Bonn and Trier. Paris withstood their assaults between 885 and 886. Between 859 an 860 they were already deep in the Rhone Valley, and appeared in Luna and Pisa in Italy. West Europe did not stop trembling until the Normans were badly defeated at Saucourt in north France in 881, and at Leuven in Belgium in 891.

Nevertheless, peace was short-lived; since 991 the Danish kings had been leading their Viking warriors in many a skirmish and had conquered England. In Italy in 1057–1085, the Greek possessions were regained, and the Lombard principalities conquered. And between 1061 and 1091 the Arabs overran Sicily. Two Norman states arose, which united at a later point in history. Gaeta and Amalfi were held in subjection and Lower Italy experienced her golden age of prosperity and intellectual growth. During this



period Heinrich IV, who married Konstanze, the Norman heir in 1186, brought this realm under his own rule.

Other Normans pressed toward the East, where they founded a state around Novgorod, sailed down the Volga to the Caspian Sea, and were occasionally sighted in the vicinity of Baghdad. In 864, the Normans settled in Kiev and built forts in the middle of Slav territory. Between 860 and 907 they marched against Byzantium (today Istanbul) and often raided the rich coast of the Caspian Sea.

The Normans captured land in Wollin, Elbing and north of Libau – in fact some historians credit the Normans with the founding of Poland.

However, the Normans not only used all the known land routes, they also took to the sea in boats, subduing Iceland and Greenland; and in the year 1000 turned up in America where they settled in Labrador, Newfoundland, Nova Scotia, and further south in "Vinland." The Viking settlements were of short duration in America; but it is known that connections between "Vinland" and Greenland persisted up to the 14th century.

It is obvious that the Normans must have decidedly influenced both the history of weaponry and battle tactics. In fact, in the Middle Ages the Normans set the fashion for the use of specific weapons throughout Europe. Feudalism, feudal mentality and offensive tactics determined the nature of future wars.

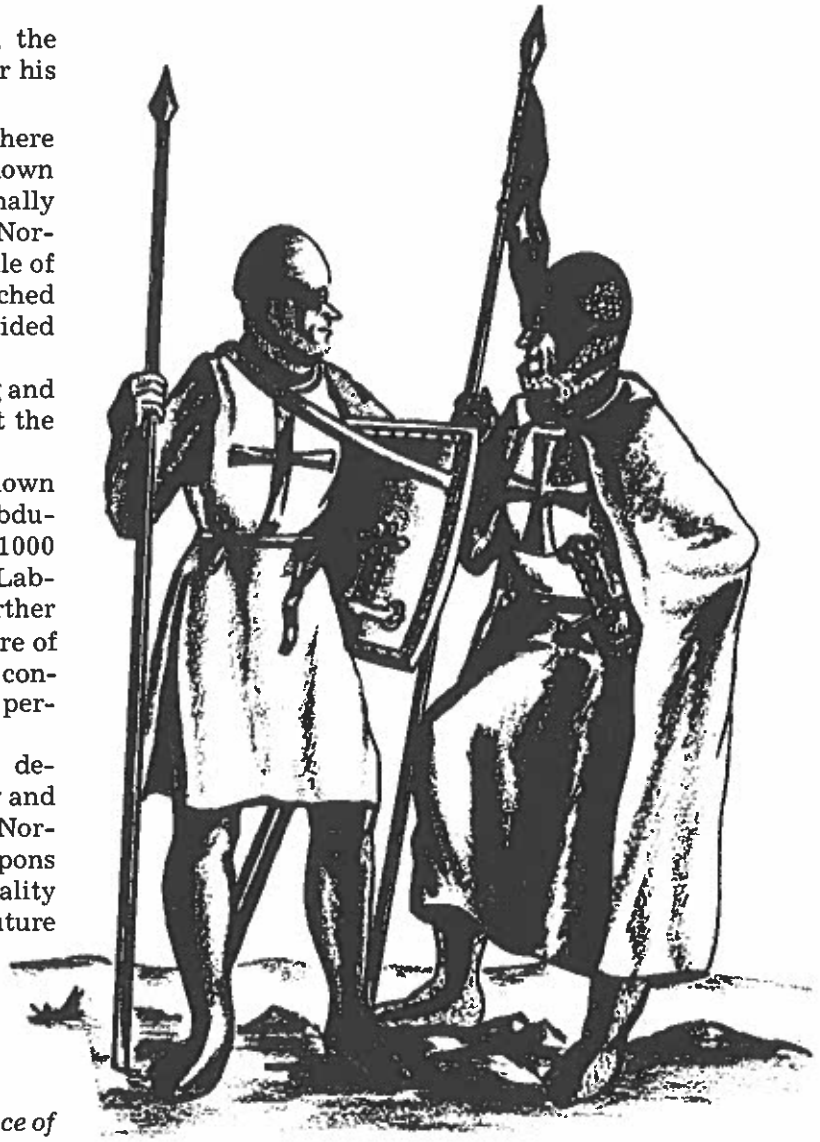
The Occident And Long-Range Weapons

Long-range weapons in the crusades – Acceptance of Oriental art of warfare – First European training centre for archery – The genesis of the knightly tournaments – Arrogance and vanity foretell the doom of chivalry

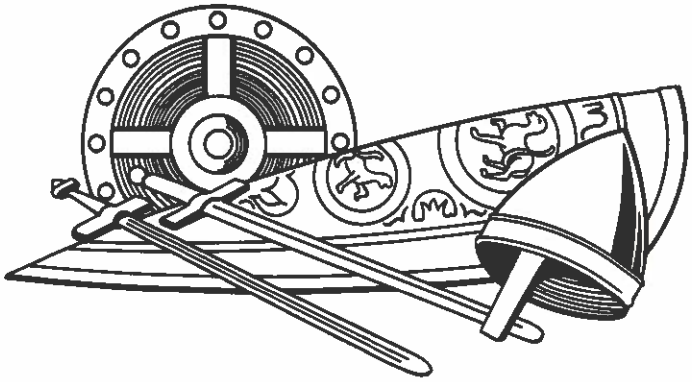
As said before, the Normans copied the ways of other peoples if they seemed to offer an advantage. Their pointed helmets with characteristic nose piece, their armour and the long spear were taken from the Orientals; their large shields and lengthy swords, on the other hand, were the tools of trade they had brought with them. Bows and catapults were used by the Normans only at the beginning of a battle, for in the spirit of chivalry the best man must win in a hand-to-hand struggle.

Only when an opponent had been chosen in the thick of the battle, did the Normans draw their swords, a custom practised by the Orientals, too. Nonetheless, long-range weapons were in existence, and after an initial hesitancy they became very popular. The knights were confronted with these downpours of arrows during the crusades, which, above all, decimated horses. Alongside the long bow, the cross-bow was used to fire steel quarrels to penetrate the knight's armour. The Oriental art of charging was likewise a terrible experience to the European knights, who did not take kindly to their enemies' spreading out to bypass the main shock detachment and then swooping in on all sides.

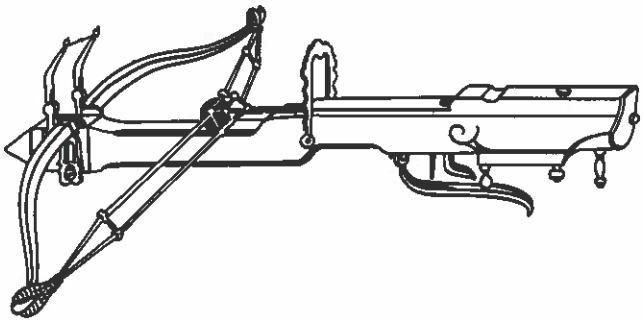
Those crusaders who managed to reach home, founded training centres for the new fighting techniques in England and Brabant (a duchy today divided between Holland and Belgium). Round about 1280 the first European cavalry was called into being that was armed with bows and arrows, scimitars, light riding spears and cross-bows.



3 *Crusader c. 1190 and Knight of the Order c. 1250*



4 *Norman arms: Round and long shield, long sword, helmet with nasal. The long shield extended from the warrior's neck to his feet.*



5 *Cross-bow c. 1580. This instrument can fire both balls and quarrels. The gear rack, embedded in the stock, was set in motion via a winder on the side of the shaft.*

6 *Jousters were adorned with colourful pomp during the heyday of feudal mentality.*

Between the various campaigns the crusaders introduced the knightly tournaments which, to begin with, had a sparring character to train knights in individual or group fighting. Later on these "manoeuvres" degenerated into entertainment for the aristocracy; and the heavier the suits of armour became, the more arrogant and vain became the contestants. Armour increased in splendour; effective horsemanship, under such great weight, slowed down. Heinrich VII was triumphal with his heavily armoured knights in Italy in 1310; but in 1315 the end of armour was in sight when the Swiss farmers beat the life out of Hapsburg knights with nothing but their halberds in the famous battle at Mt. Morgarten. The superior tactics of the Swiss led them on to success, although the knights were better armed and better trained.

In this difficult terrain, groups of knights in reserve should have awaited the outcome of the first clashes. These noble gentlemen, however, were so confident of success that they all rode into battle together without enough thought of the possible consequences. The knights paid for this lack of foresight with their lives. The Battle of Mt. Morgarten was a turning point in the history of chivalry. The heavy, extravagantly decorated suits of armour now began to give way to light breastplates, helmets, etc.; and the infantryman, who suddenly began to take a more active part, was equipped with a round iron hat or a sallet, spear and sword. Long bows and cross-bows, hitherto viewed by the knights with disgust, came into their own. At about this time, soldiers using firearms appeared in various European armies, and to everyone's surprise these gunners were particularly successful. The news of the devastating effects gunpowder had in the Battle of Liegnitz spread like wildfire, and stimulated "inventors" to greater efforts.

7 *Punching a hole through a wall with a carriage-mounted cannon. Elevation was achieved by passing iron bars through side supports. Note the small wooden wheels and the large shield.*

The Age Of Firearms

Democratization of the army – From handicraft to gunnery – Artillery at Crecy-en-Ponthieu – Change in battle tactics – Was the use of gunpowder an accidental discovery? – Firearms spread throughout Europe

The fate of jousting was sealed, its principles belonged to the past. Artillery becomes an important factor in warfare and rapidly finds acceptance in all parts of Europe. Before long, gunnery was on an equality with the classical horsemen and infantry soldiers. When one investigates the beginnings of this new branch of the service, one is surprised to learn that the first artillerists were none other than the artisans who wished to test what they had concocted; not the malicious killers whose daily bread was ravaging, raping and butchering. The war lords then hired these artillerists wherever they could – in the Turkish army Italians, Greeks and Hungarians manned the cannon, and in the Burgundian it was Italians and Germans.

Further development went at a good pace, and some 80 years after the Battle of Liegnitz, all larger towns were equipped with cannon. In 1350 artisans began to cast cannon. About 10 years later the so-called "length of span" handcannon put in an appearance and, in 1380, cannon barrels were cast in bronze. The oldest illustration known of a cannon was drawn by the English cleric Walter de Milimete in circa 1330. It is bottle-like in design, and could fire bolts or arrows. The English were also the first to fire cannon in closed formation. Six English cannon helped to win the day in a battle against the much superior French cavalry under Philipp II at Crecy-en-Ponthieu, north of Abbeville. The English victory, however, could not solely be ascribed to firearms. As at Mt. Morgarten, a change in tactics led to success. Contrary to the Hapsburg knights, the English riders were not too haughty to dismount and to fight alongside their archers.

Even today the historians are not sure whether Europe imported the knowledge of gunpowder from Asia, or whether the discovery was subject to the caprice of fortune. Demmin, in his Enzyklopädie der Waffenkunde, opines that it was a mere accident that someone visualized a body being propelled down a metal tube by means of an explosive charge. He pictures someone being blown into a corner, after mixing saltpeter, sulphur and charcoal in a kitchen mortar. Demmin also sees a connection between the two meanings of the word "mortar," postulating that first mortars were kitchen mortars with a touchhole buried at an angle in the ground!

W. Boeheim, on the other hand, writes in his book Waffenkunde that firearms spread across Europa via Spain. In Spain, gunnery was highly developed and the Moors were very experienced artillerists. Only very slowly did the new arm get a footing in France and England, for in these two countries the tradition of the knight was still strong. The Italians, who were more interested in trade than traditions, were open-minded and accepted all innovations for what they were worth.

Early Cannon

Rapid development causes confusion in names and calibres – The "Kriemhild" of Nuremberg – From crude tube to carriage-mounted cannon

The first cannon were of iron and consisted of several layers, the innermost of which was forged around a mandrel. Strips of metal were longitudinally fastened to the outside of this tube and red-hot rings were forged around these strips to hold the barrel together.

The guns of this period did not have a name, were middling in size, and shot large roundish stones. In the mid-14th century bolders were carefully hewn into excellent cannon balls. For small calibres, iron balls were cast. It must have been during this period of history that the question of standardized calibre arose. The French, Spanish and Italians spoke of "bombarders," the Germans "Büchsen." In France small "bombarders" were termed "bombardelles" or "cannons." All small calibre guns and handguns were known by these names. The word artillery is derived from artilleurs (artist) which meant, at that time, bow or cross-bow maker.

Bombarders and cannon were crude breachloaders. Gunpowder and projectile were loaded at the rear of the barrel and the "breech block" held in place with metal or wooden wedges.

Once firearms had been accepted, further developments followed in quick succession. It is impossible today to say where, when, who introduced the greatest improvements. Great advances were made in metallurgy so improved barrels were being cast. In Germany superior cast cannon appeared at the end of the 14th century, although hand forged barrels existed until the end of the 15th century.

Improvements in casting technology tempted the gunmakers to produce larger and larger cannon. The German mercenaries called these heavy, thick-bellied cannon "Metzen," harlots in English. To avoid chaos in terminology, the Germans also introduced a system of classification:

Scharfmetze – A 100-pounder able to fire a a ball weighing 46.7 kg. Calibre 23 cm, barrel length 3.45 m, weight 5,140 kg

Kanone – A 40-Pounder able to fire a ball weighing 18.7 kg. Calibre 18 cm, barrel length 3.5 m, weight 2,900 kg.

Mittlere Kanone – A 24-pounder able to fire a ball weighing 11.2 kg. Calibre 15 cm, barrel length 3.4 m, weight 2,300 kg.

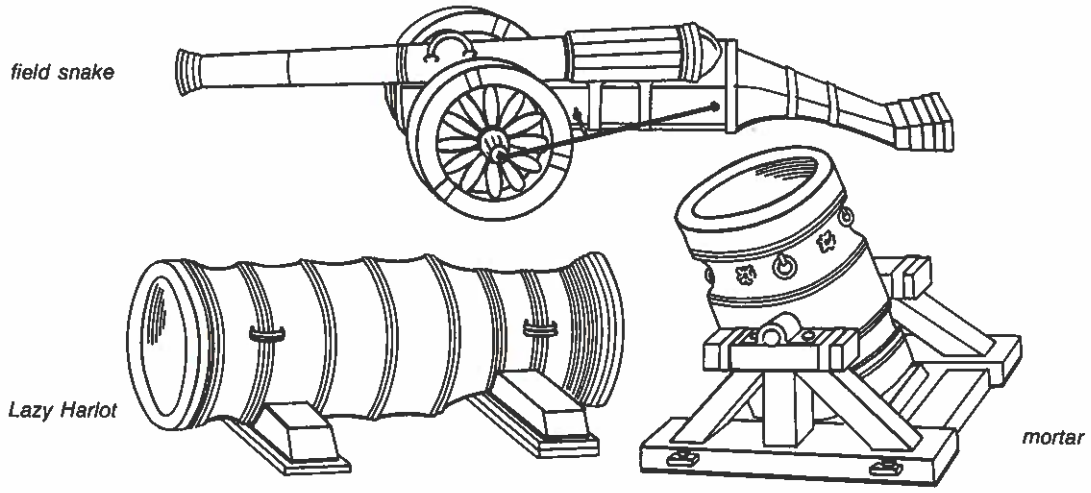
Ganze Schlange – A 12-pounder able to fire a ball weighing 5.6 kg. Calibre 12 cm, barrel length 3.9 m, weight 1,380 kg.

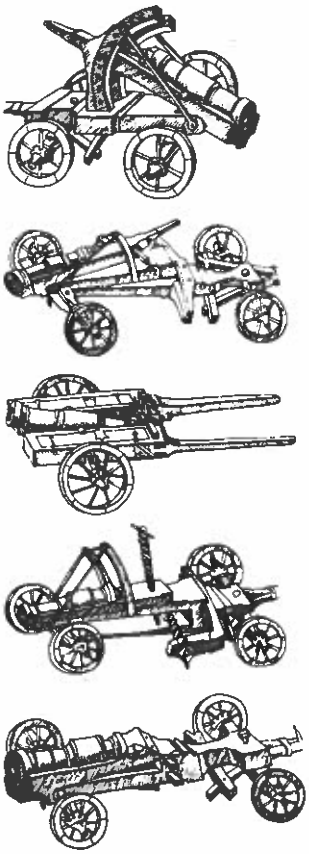
Halbe Schlange – A 6-pounder able to fire a ball weighing 2.8 kg. Calibre 9.1 cm, barrel length 3.5 m, weight 1,230 kg.

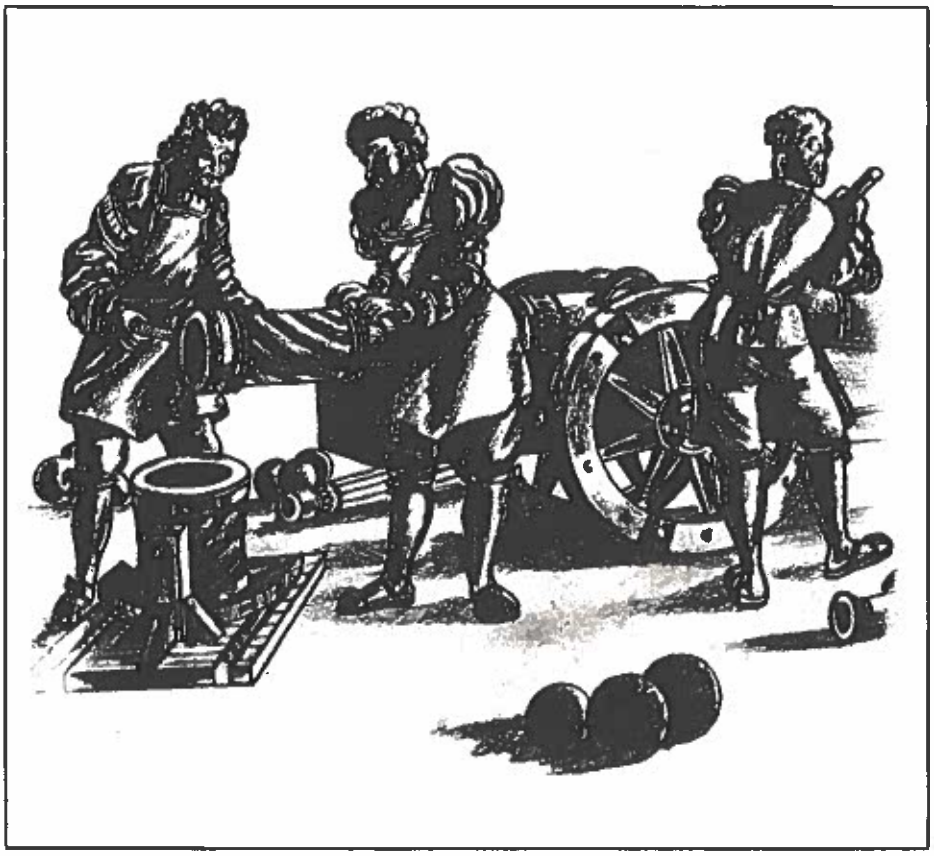
Falkonett – A 3-pounder able to fire a ball weighing 1.4 kg. Calibre 7 cm, barrel length 2.8 m, weight 795 kg.

Mörser – A 100-pound mortar able to fire a ball weighing 46.7 kg. Calibre 35.5 cm, short barrel of 1.5 m, weight 2,570 kg.

8 *Cannon used during the reign of Emperor Maximilian*







9 *Cannon makers during the reign of Emperor Maximilian*

Cannon were very heavy instruments of war, requiring men of iron to move them around. However, the ancestor of our modern Long Toms put in an appearance as early as 1388 when Ulrich Grünwald of Nuremberg made his "Kriemhild," a giant gun costing 500 guilders which could punch a hole in a wall 6 feet thick at 1000 paces. It is not known how many artillerists manned "Kriemhild," but it is said that 58 horses transported this giant! Twelve horses drew the barrel, 16 the carriage, 4 the winder, 6 the shield, and 20 the 15 stone balls, of which only 3 could be transported per wagon.

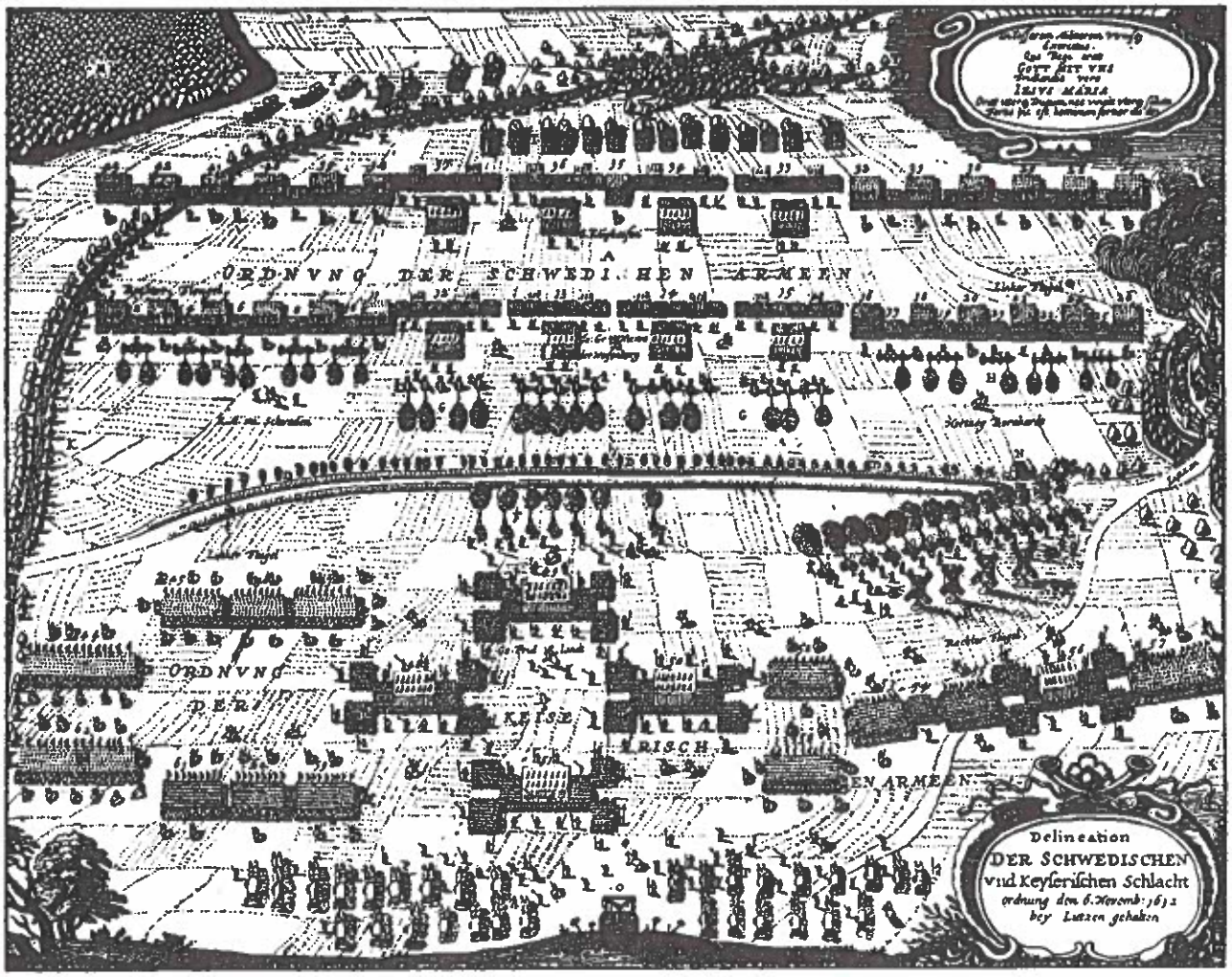
The 14 lbs of gunpowder caused such high recoil that it was difficult to re-position "Kriemhild" after each shot. Strong wooden beams were anchored in the ground and used as recoil pads, but after 3 or 4 days this 5-ton cannon had to be shored up anew with fresh beams.

Later, attempts were made to half bury the barrel in the ground, and later still it was laid in the hollow of a beam. In about 1450 the barrels of cannon were fitted with 4 trunnions, and not until 40 years had elapsed was the two-trunnion version introduced, whereby the barrel could be elevated.

The curtain drops

Reducing the weight and speeding up reloading time – Leather cannon at Hohensalzburg and in the Thirty Years' War – The first multi-barrelled guns

The early cannon had two definite disadvantages: they were too heavy and too slow in reloading. To reduce weight a so-called leather gun was constructed, whereby rope was wound tightly around the inner metal layer of the barrel and covered with a shrunk-tight leather casing. These cannon were used in 1525 when the citizens of Salzburg revolted against their Archbishop, Matthäus Lang, and during the Thirty Years' War by the Swedes.



10 *Formation of the troops at the Battle of Lützen, November 6–16, 1632. Wallenstein's army is in the foreground, behind the road to Lützen-Leipzig await the Swedish army under King Gustav Adolf. The artillerists in the front lines open the contest. The Swedish king has positioned himself on the right-hand side between the gunners, Duke Bernhardt on the left. Wallenstein stands in the square in the centre of his troops. The baggage train is lined up behind the formation (not shown in illustration). A copy of the engraving "Theatrum Europeum."*

Robert Scot, a Britisher, introduced these leather bound cannon to the Swedes when serving under King Gustav Adolf. The range of these guns was not very great and they could shoot only a quarter of the standard load for their size. In 1631 they fell into disuse as they were a failure in the Battle of Leipzig.

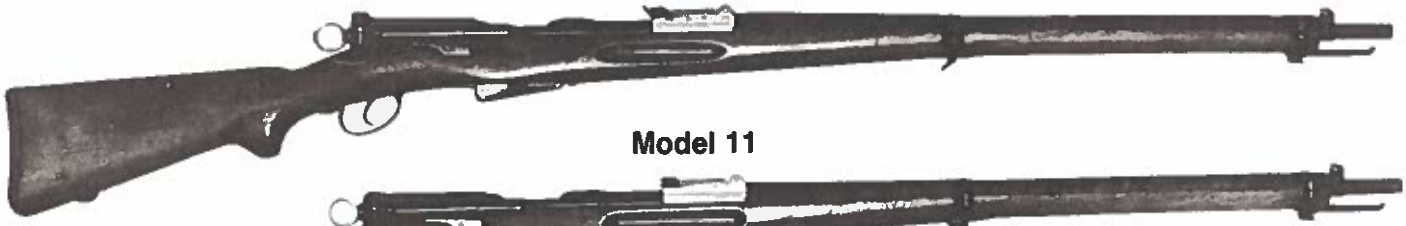
During the mid-15th century the first multi-barrelled guns appeared, and in German there is an number of names for them, including: red snake, death organ, screaming gun, and falling hail. One of these pieces from an arsenal of Maximilian I has 40 barrels mounted on a two-wheeled cart. Another of these repeaters of the 17th century had 42 barrels formed into a triangle, and could fire 6 volleys.

These final lines are the curtain drop on the "Introduction of Firearms to Europe," as at this stage firearms were an essential part of the equipment of all European armies. The object of this article was to highlight the difficulties initially experienced since the advent of gunpowder, not to deal in depth with ballistics and the development of the handgun, which can be gone into another time.

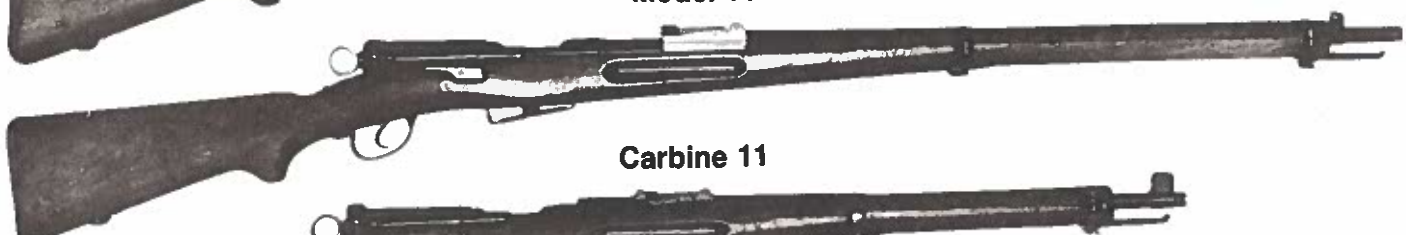
The remark is apt that every gun is developed for its later use, irrespective of whether or not it was successful when first made.

The 1911 Swiss Service Rifles

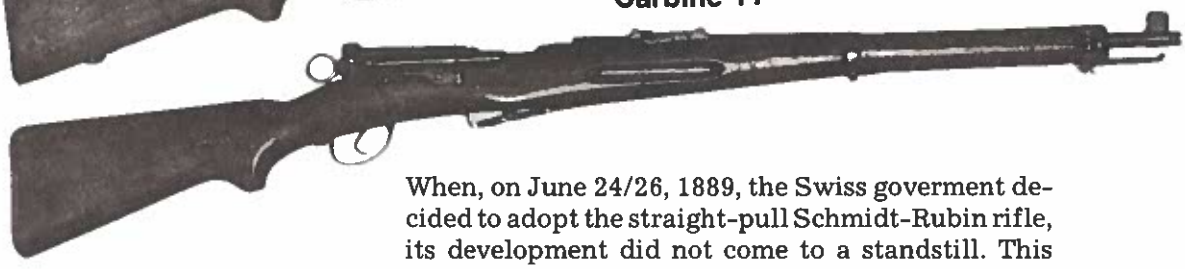
Model 96/11



Model 11



Carbine 11

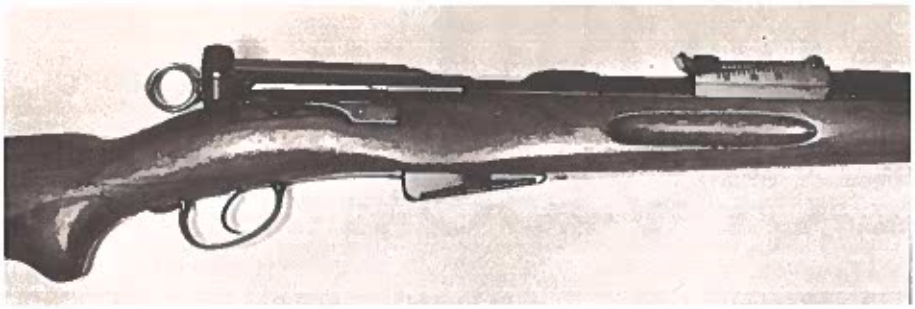


When, on June 24/26, 1889, the Swiss goverment decided to adopt the straight-pull Schmidt-Rubin rifle, its development did not come to a standstill. This rifle's main disadvantage was its long vibrating bolt with rear locking lugs.

The bolt was shortened by 20 mm and the lugs were moved to the front. This model became known as the 89/96. However, although the action now functioned perfectly, the 89/96 rifle was soon to be superseded. A Col. Rubin introduced a copper-clad boat-tailed bullet, which had nearly double the effective range of its predecessor. Fortunately, the 89/96 rifle could be converted for the new 1911 cartridge. The conversion, with new barrel, sights and magazine, as well as semi pistol grip, became known as the 96/11 rifle. On June 14, 1911, the Swiss adopted the Mod. 11 rifle and the Mod. II carbine. These superb weapons, until recently, were still used by the Swiss Territorial Reserves, and at the ranges, older shooters still practise with them.

TEXT AND PHOTOS BY EDMUND FASNACHT-ROTH

Technical data

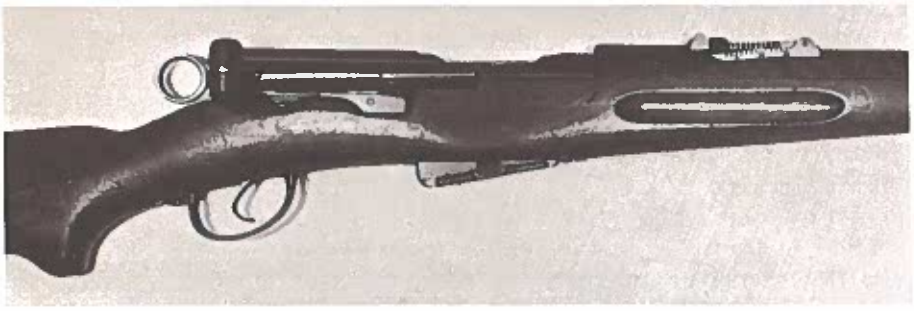


Model 96/11

Model 96/11
Pistol grip subsequently worked into stock; butt plate rounded as in Models 89 and 89/96; adjustable rear sight from 300 to 2000 m; swivels for strap.

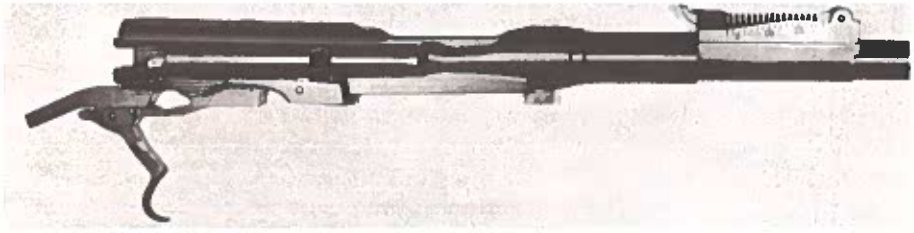
Model 11

Model 11
Rear sight as in Model 96/11; one-piece pistol grip; flat butt plate; trigger guard as in Carbine Model II; swivels for strap.



Carbine Model 11

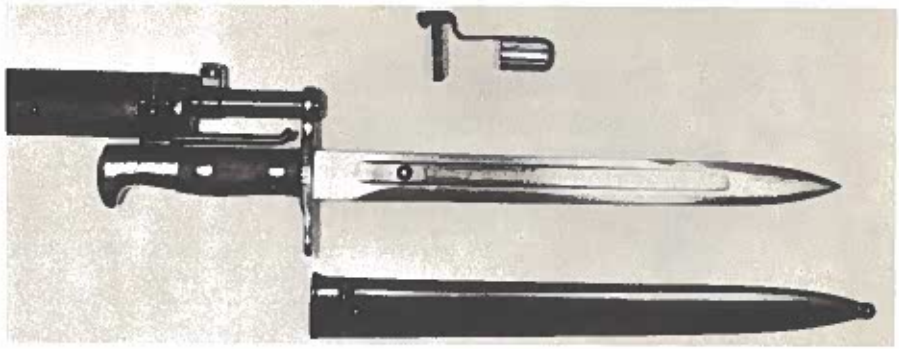
Carbine Model 11
Adjustable sight from 300–1500 m; swivels mounted laterally; flat butt plate.



Model 96/11 and 11

Carbine Model 11

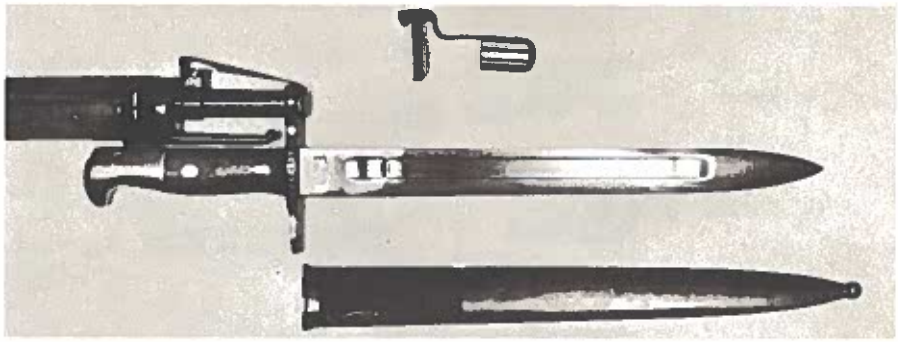
Model 96/11 & 11
Receiver and barrel with adjustable sight



Model 96/11

with bayonet M 89/11. As the M 89 knife bayonet often slipped out of its sheath, a stud was mounted on the blade. Muzzle cap as in Models 89 and 11.

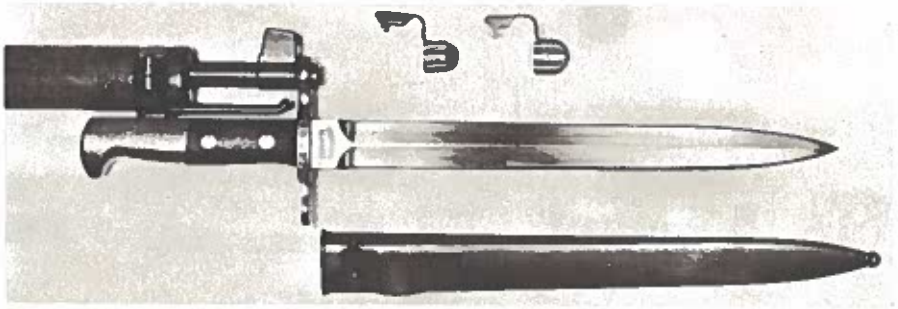
Model 96/11



Modell 11

with knife bayonet M 11. Ramp machined into rear of blade to prevent sheath from dropping off. Muzzle cap as in Model 89 and 96/11. A test muzzle cover (1914) is seen in here which could be used with the bayonet.

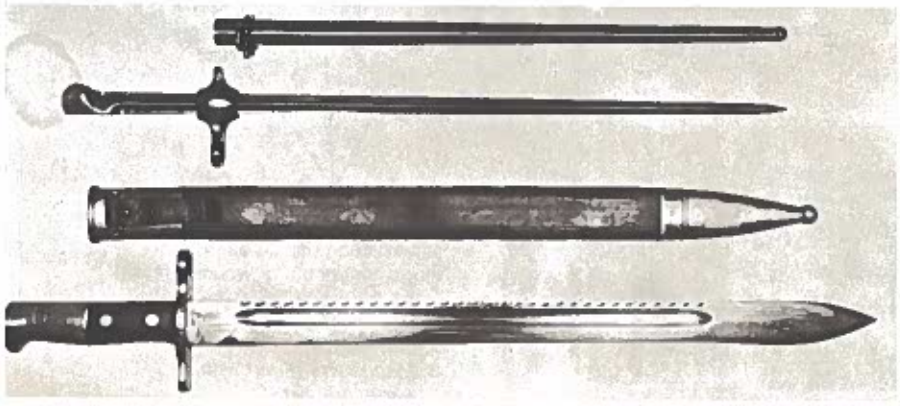
Model 11



Carbine Model 11

with knife bayonet M 18. Note protected front sight. The left-hand muzzle cap was the first version, the other cap and the bayonet can be used on Carbine Model 31, too.

Carbine Model 11

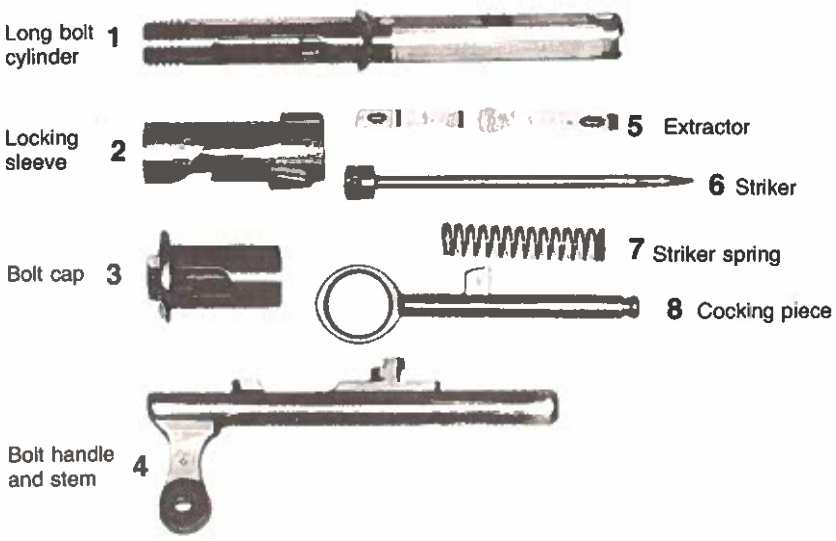


Bayonets

also used with Carbine Model 11: top: rod bayonet M 1900 for cyclists and machine gunners. bottom: sabre bayonet M 14 with saw back. This bayonet was issued to special troops for use as a tool. Metal and leather sheathes were available.

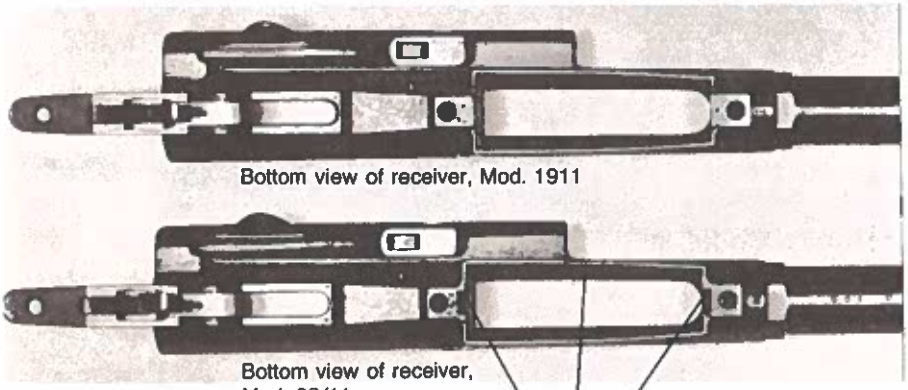
Bayonets

M 1911 Schmidt-Ruben bolt with locking lugs at front of sleeve.



Ammunition

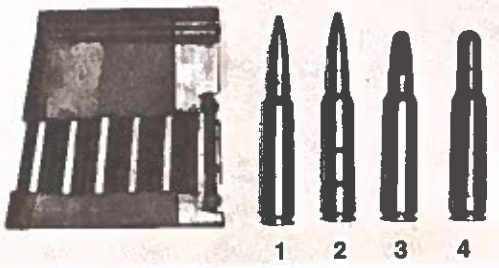
1. Dummy cartridges are of brass with centre cannelures. Clip, red.
2. Blanks with coppered hulls and black base.
3. Live rounds were available in 3 versions:
a) Nickel-plated steel capped lead bullet. Clip, brown.
b) Lead clad steel core bullet, clip and base, violet.
c) Tracer bullets with lead core, base, red. Packed in units of 10.
4. Manoeuvre ammunition:
a) With hollow wooden bullet, green.
b) With plastic mantle, green. Both have white clips. During WW 2 cartridge cases were made of steel and light metals, too.



Bottom view of receiver, Mod. 1911

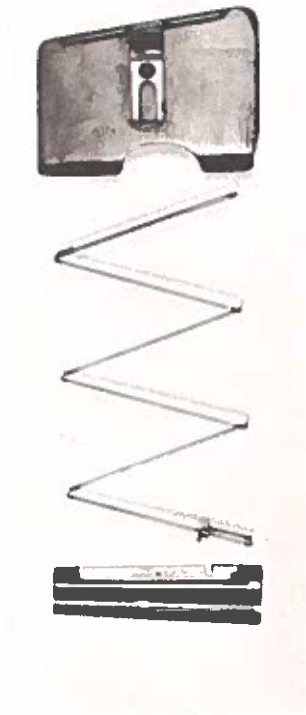
Bottom view of receiver, Mod. 96/11

Cutouts for the old, long magazines, Mod. 89/96 still existed (incl. cutout in the magazine mouth of wooden stock).



1 *Live round*
2 *Drill round*
3 *Manoeuvre round with wooden bullet*
4 *Plastic manoeuvre round*

▲ *Loader (brown) with 6 rounds*



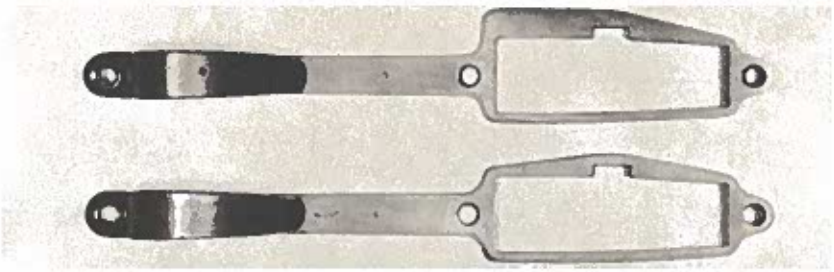
Magazine with spring and follower, for all three models

Serial numbers

Breechblock, barrel, barrel extension, magazine and stock all bear the full serial number. The other parts, however, only the last 3 digits. In some cases the canton, e.g. Zurich or Berne, is stamped on the butt plate.

The acceptance stamp for metal parts is "+", final proof mark " ℙ ", which can be found on the barrel or barrel extension. A "P" (private) on the barrel extension signifies that the weapons has passed into the possession of the rifleman after his completing 30 years of service.

Trigger guard furniture, Mod. 96/11



Trigger guard furniture, Mod. 11, for rifle and carbine

Cleaning kit complete with two tubes of grease, a pull-through, barrel reflector, chamber cleaner and spare strainer for the pull-through.

Rifle data

	Rifle 96/11 + 11	Carbine 11
Calibre	7.54 mm	7.54 mm
Total length	1310 mm	1103 mm
Weight (unloaded)	4600 grams	3900 grams
Line of sight (at 300 m)	693 mm	490 mm
Barrel length	780 mm	592 mm
Barrel weight	1312 grams	912 grams
Right-hand twist, 4 grooves	270 mm	270 mm
Width of grooves	3.94 mm	3.94 mm
Depth of grooves	0.13 mm	0.13 mm
Width of lands	1.97 mm	1.97 mm
Magazine capacity	6 rounds	6 rounds
Trigger pull	800 grams	800 grams
Let off	1600 grams	1600 grams

Cartridge data

Weight	26.8 grams
Weight of case with primer	12.3 grams
Weight of charge	3.2 grams
Weight of bullet	11.3 grams
Length of cartridge	77.5 mm
Length of case	55.5 mm
Length of bullet	35 mm
Max. pressure	3200 atm.
Proof cartridge for Rifle and Carbine	3800 atm.

Age groups subject to military service in Switzerland

Active	20 – 32 years of age
1st reserve	33 – 42 years of age
2nd reserve	43 – 50 years of age

Prussian jaegers (1870/71) with needle gun

Firing

Blackpowder shooting is becoming more and more popular, for modern guns and their ammunition have been so perfected that the marksman need only pull the trigger. It is quite a different story with guns firing blackpowder. The guns, especially originals, have to be put in working order and ammunition is home-made, not bought. The nice thing about home-produced cartridges is that one needs only the simplest of tools, and the kitchen table. After one has cast his own lead balls, the very idea of shooting a gun that has remained silent for a hundred or more years is so enthralling that it matters little whether the bull's-eye is hit or not!

Blackpowder enthusiasts use flint or percussion lock muzzle loaders as well as early centre-fire, single-shot rifles such as the Snider, Werndl, Henry and Springfield, etc. Situated between these two groups is a rifle particularly dear to the hearts of us Germans, viz. the needle gun. The Dreyse was the very first military breech loader for fixed ammunition and is the great-grandma of all bolt-action rifles.

Man requires three things when shooting a needle gun – patience, a gun, and ammunition. Patience can be put to a severe test when trying to procure such a gun. There are no modern needle gun replicas.

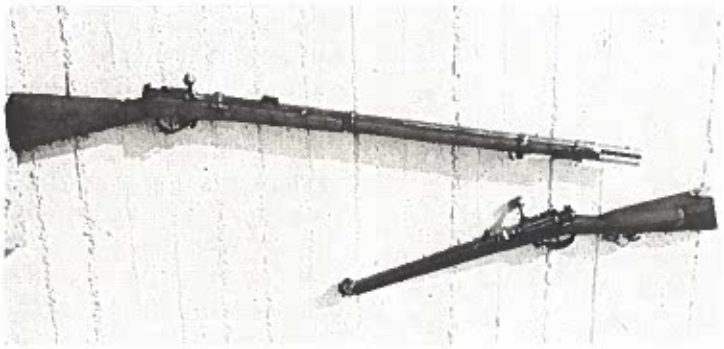
the Needle Gun

How a Dreyse functions does not interest us here. You can look that up if you want to in other gun literature.

We were determined to have a needle gun rise from the dead, but as mentioned earlier, one's patience can be put to a severe test when trying to procure the right gun. There are no needle gun replicas. However, we were fortunate, very fortunate, in finding two rifles and one carbine in pretty good shape, within three months. The carbine is Prussian, Model 1857, built 1871. The rifles, from Brunswick, bear no model designation other than the year of construction: 1868 and 1869.

According to the stampings on the receiver ring, both rifles saw service in the same regiment. One of the rifles was made by SP & SR, Suhl, the other, together with the carbine, by Crause, in Herzberg. The three firearms have the same type of action, apart from the "air chamber." With the carbine the needle assembly was so constructed that it did not enter the air chamber. All three barrels were bored for 15.43 mm, the Prussian military calibre.

After many days of carefully removing dust and grease that had accumulated in a century, three ugly ducklings turned into virtual swans, inside and out. These firearms were in such good condition that we felt no qualms about shooting them. Indeed, with a clear conscience we could have



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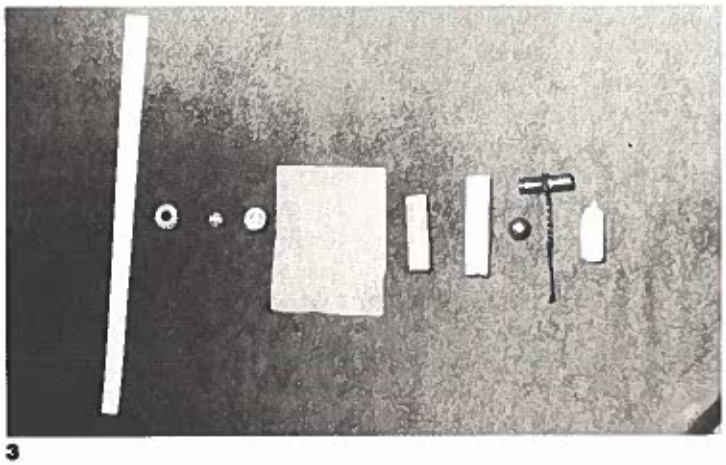

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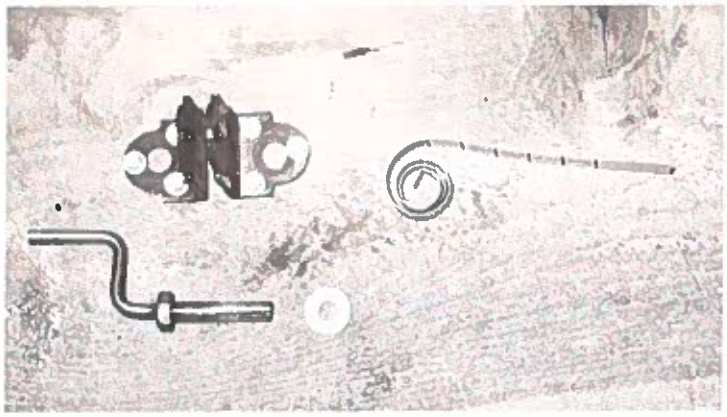
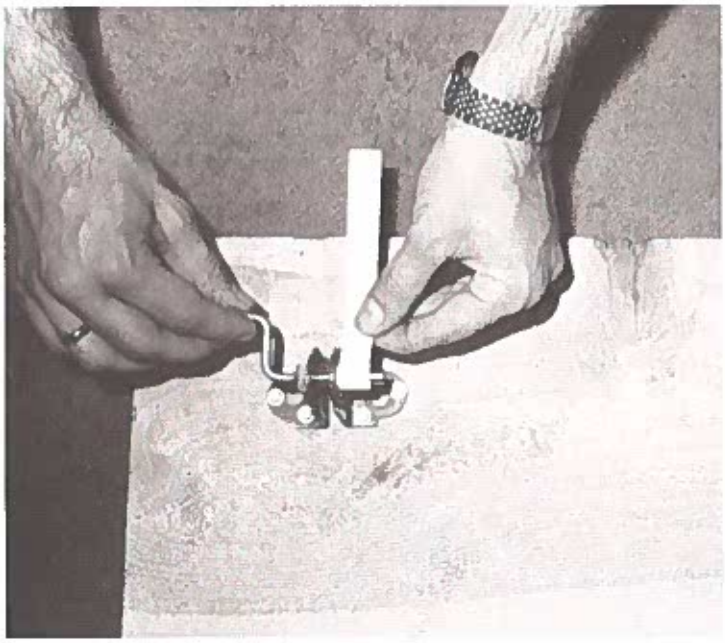
1 *Rifle and carbine.*

2 *.64 bullet, cartridge, and fired bullet (soft landed).*

3 *The birth of a cartridge.*



4 *Crank for winding prop.*



5 *Winding the prop.*

showed up at roll-call, if only the needles had not been broken! Our next task, therefore, was to replace the needles. This is simpler than one might think. The long, thin Dreyse needle is just waiting to be broken off, especially when stripping and piecing together. Our great-grandfathers will have broken one or two of them, I'm sure! That is why these guns have been designed to permit quick needle changing with basic tools.

The needle carrier has a little hole in its front into which the needle is soldered. Of course, the base of the old needle must be removed first. If this base is long enough to be pulled out with pliers, all well and good; if not, the stump will have to be removed the hard way. The face of the needle carrier is filed down until the needle sticks out sufficiently to be grabbed by the pinchers or pliers. In stubborn cases the needle carrier can be warmed over an open flame. But for God's sake, don't make it red hot!

For want of something better, we used a normal sewing needle. The right thickness is adjudged by passing the needle through the guide orifice that lies to the front of the action. The fit should not be sloppy, yet not tight enough to cause binding. Determining the right length is just as simple. When the gun is cocked, the bolt end sticks out of the rear of the action. The length of this protrusion, plus the depth of the hole in the carrier, reveals the correct length of the needle. You don't have to be pernickety about exact length, we found 1 or 2 mm didn't matter much.

Shorten the needle from the pointed end, if necessary. The eye should not be removed, it is a good anchor for soldering. The point, or point of cutoff, should be blunted. Modern sewing needles are chromed, so for soldering this will have to be removed around the eye. The eye is then filled with solder and the needle placed into the hole of the carrier. We used silver solder. The only difficulty in soldering is that everything must be done very rapidly. Anyone who does not want to buy a soldering iron, etc. can take the pieces to the local metal workshop, or garage for that matter.

The near side of the needle guide of our guns was padded with leather. This serves as a buffer for the needle carrier and as a sealant for the guide orifice, to prevent gas from entering the inside of the bolt assembly. Of course, these leather patches must be as supple as possible. In our guns the bits of leather left over were as dry as a bone. We cut out new patches

from shoe leather (soles) and soaked them in Ballistol for 14 days. The leather reacted beautifully after this treatment and we couldn't have wished for anything better.

Now the guns were in form again. We needed ammunition! A needle gun cartridge consists of:

a lead ball
a rolled cardboard prop with primer
blackpowder

all enclosed in a paper wrapper. So it's just child's play, if you've already made them. The only special tool one needs is a bullet mould.

Pouring your own

There were a number of different cartridges for the Prussian needle guns. They differed chiefly in bullet and prop design. The oldest type was the ball that filled the grooves of the barrel rifling. From 1855 onwards the rolled cardboard prop of the long bullet filled the grooves. We chose the round ball, for it is simpler and cheaper to mould. A .64 bullet mould was used. The diameter of the finished ball measures 16.2 mm. This roughly corresponds to the bore of the barrel. Our bullets were cast from soft lead piping.

They chambered and fired wonderfully. The bullets took to the grooves, and accuracy was remarkably good. Fig. 2 shows the groove marks on a fired bullet.

Making the prop

Thin cardboard (target paper) is cut into strips. Length depends on the thickness of the cardboard. Our length was 31 cm. This must be pre-tested. The prop is of bullet diameter. One side of the strip is cut diagonally to measure 3 cm at one end and 2 cm at the other. Two such strips are placed one over the other, straight edge on straight edge, wide end on wide end.

We built a small crank (Fig. 4) from the parts of a child's construction kit. The narrow end of the cardboard strip is fed into the slot of the crank and wound into a tight coil. Which can be seen in Fig. 5.

Two thin strips of cardboard are better than one thick piece, since the outside strip, when wound around the inside strip, is about 1 cm shorter. Thus the ends slope off into the circle of the prop; they don't terminate in an abrupt step, as would be the case with thick cardboard. Both ends are then glued. To keep the strips in place stout rubber bands are used until the glue has dried. Only then are the props removed from the winder.

The finished prop should be straight on one side and concave on the other. In the middle is a small hole (thickness of the crank) of about 6 mm diameter. The primer is glued into this hole with the primer flange resting on the straight side of the prop.

The primer that suited our purposes best was the

6 *Action open*
7 *Inserting the cartridge.*
8 *Thumbing the cartridge into the chamber.*

6

7

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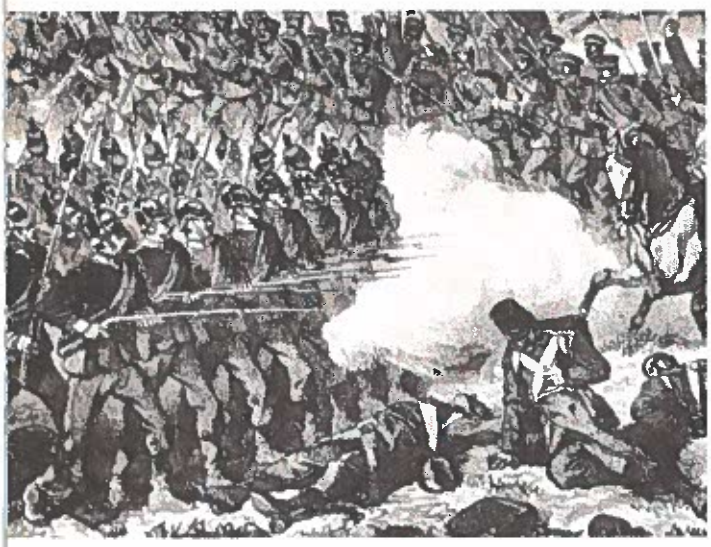

The Battle of Königgrätz, 1866. The Prussians, armed with needle guns, gave the Austrians who were still armed with muzzle loaders a terrific pasting.

No. 1018 from Dynamit Nobel. They have a metal flange.

Fig. 3, left to right, the cardboard strip, the finished prop with a hole in the middle, the primer, the prop with primer mounted.

Fitting the paper jacket

We did not require a tough, military-type jacket, and chose a paper that would burn up completely. We found that normal tissue paper did very well. We laid the tissue paper in stacks of 20 to 30 sheets, and cut them into squares measuring 10 to 12 cm. One can, of course, do a made-to-measure job and cut each sheet separately. However, the cartridges are none the prettier, it just takes longer if each sheet is cut separately. Once cut, the stacks of paper are immersed into a solution of 1 litre water and 2 – 4 teaspoons of saltpeter. Keep them in it for about 30 seconds. They should then be drip-dried and placed on a bundle of old newspapers, preferably in the open. The tissue paper will dry over night. Make no attempt to dry the tissue paper on a hotplate or in the oven, else your work will go up in flames.

By soaking the paper in a solution of saltpeter it will become a little brittle, but will burn completely in the firing chamber.

Each sheet of tissue paper is rolled over a winder with a diameter of 16.5 to 17 mm. As a winder we used a 20 gauge shotshell, the base of which had been cut off. The paper is so wound that at one end of the winder the paper protrudes about 1 cm. This overlap is turned in and glued, the winder being pulled out of the other end. Fig. 3 shows winder and finished paper jacket.

Loading the cartridge

Only blackpowder may be used! As these needle guns chamber rather a large size calibre, the powder should not be too fine. We used Hunting Blackpowder No. 3. The load of the original military cartridge weighed 4.6 grams. Later it was increased to 4.9 g. Seeing that neither of us had war-like ambitions, and didn't want to shoot at 600 m, we used the case of a .308 Win. (NATO) with sawn-off neck for a blackpowder measure.

A moderate amount of powder is poured into the paper jacket, the prop, primer end first is then lowered into the jacket until it reaches the powder. No grains of powder should adhere to the side walls of the paper jacket, i. e. between paper jacket and prop. The ball is then dropped into the concave head of the prop. Closing the paper jacket over the ball, the ends are twisted into a sausage and cut off about 1 cm above the ball. The sausage bit is then pressed down with one's thumb. The cartridge now has to be greased. We mixed cooking fat, beef dripping and beeswax. When cold the grease should form a very hard shell. Only the ball end is dipped into the liquified concoction. The powder must not be brought into contact with grease. Fig. 3 shows bullet, home-made measure, and the finished cartridge.

Firing

Our cartridges can be fired in both the rifles and the carbine. Loading is no problem. Figs. 6, 7 and 8 show the loading procedure. We experienced only very few duds. The gas seal worked perfectly, and recoil was light, even with the carbine. But this was probably due to our weak load.

Despite our pipsqueak cartridges the guns were astonishingly accurate at the target range; indeed, one of the guns is now being used in America for hunting.

We can make no claims that our cartridge is the best, but that's the wonderful thing about blackpowder shooting, everyone can "roll his own" according to his own tastes . . .

The Age of Armour

H. Brutsche

Many primitive races knew how to make use of animal hides and other natural materials to protect themselves from their assailants. Even the ancient Fijians plaited raffia combat suits that covered the entire body!

Field armour, 1547, of Archduke Ferdinand of Tyrol, from the Adler collection. Photo: Kunsthistorisches Museum Vienna/Austria

Anyone who has been to a couple of museums will realize that protective clothing of leather, metal mesh and scales was well known to the civilized nations of the Old World. Depicted on a relief in the British Museum is an Assyrian battle-dress presumably of hide, covered with metal plates (Fig. 2). One can still admire the fragment of an Egyptian hauberk (shirt of mail) which is covered with overlapping scales. Its inscription tells us that this bronze battle shirt was made in 1500 B. C. At the beginning of this century the Egyptian Museum in Vienna housed an armour-like dress of crocodile skin, also dated circa 1500 B.C. (see Fig. 3). In Greece the hoplites, heavily armed foot soldiers, wore scale armour in 500 B.C.; yet plate armour was not strange to them, as an excavation has brought to light. A Spartan bronze fi-

gure was found wearing plate armour that fitted the contours of chest and back parts. Brassarts (armour for the arm) and jambes (for the legs) were also in existence, although Fig. 4 does not perhaps convey a realistic impression. The Romans adopted the armour of the Etrurian warriors c. 350 B.C. and improved on it.

It usually extended to the hips and was complemented with brassarts and jambes. However, it must be said that the Romans, over the centuries, wore a variety of armour and materials. The monument of Valerius Crispus is dressed in a cape-like leather armour with protected shoulder parts. The museum in Mainz, Germany, took this typical legionary attire as an example for their life-size model of a Roman soldier. Officers often wore scale armour, as depicted on the grave stone of Centurio Quintus Publicus Festus of the XI Legion (Fig. 5).

Then again, iron plate armour with shoulder reinforcements were in use. As added protection, metal bands 6–8 cm in width were wound around waist and lower chest, although leather strapping was usually preferred for this flexible part of the body. Unfortunately, it is not always possible to tell what a garment was made of by examining a representation carved in stone. And one must not forget that military leaders chose pompous parade uniforms to present themselves at their best for posterity.

An important piece of armour with Greeks and Romans alike was the leg coverings. The Greeks being equipped with relatively small shields, the shins were thought to be particularly susceptible. In hand-to-hand fighting, of course, one's shins were exposed to kicks and blows with the shaft of the lance. However, the weight of these jambes can only have been a hindrance. In Athens, and probably elsewhere too, these lavish leggings were only worn by the wealthy classes as a sign of distinction.

Since the 2nd century B.C. only the Centurions, those 60 selected officers attached to each legion as the backbone of the army, were allowed to wear such leggings. It can only be as-

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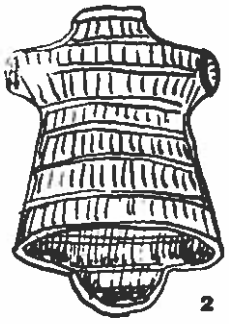
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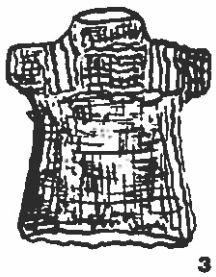
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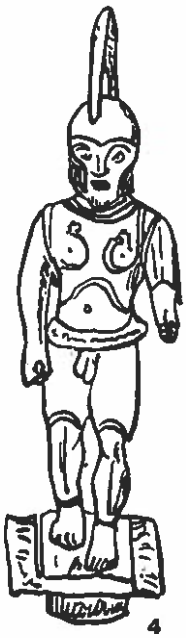
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1
Fijian combat suit of raffia. Photo: Völkerkundliche Sammlungen der Stadt Mannheim, Germany.

2
Assyrian battle-dress with rear extension. Copy of a relief in the British Museum, London.

3
Egyptian hauberk with overlapping scales, c. 1500 B. C. (after Denon).

4
Spartan bronze figure displaying contour-fitting breastplate. (excavated near Sparta)

5
Valerius Crispus in the leather armour of the Roman legionaries. (drawing from a monument)

6
Roman legionary wearing metal hoops and shoulder pieces. (drawing from Trajan's column)

The Age of Armour

sumed that these jambes, as worn by Homer's heroes in the Iliad, were worn as decorative pieces by charioteers, and that in later periods they were also worn by foot soldiers as a status symbol.

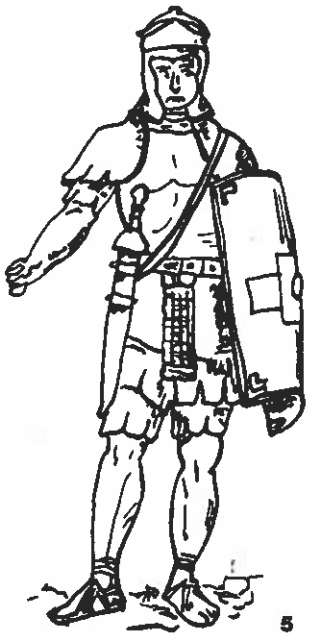
Teutons, Franks, Normans

The early Germanic tribes did not wear armour, as far as we can tell. During the period of mass migration, both antique and oriental influence must have made itself felt. Not much can be said about oriental armour of that period, for today there is hardly any in existence.

In 1799 when the so-called "Treasure of Attila" was unearthed near Nagy Szent-Miklos in Hungary, which dates back to the 5th century, a vessel of pure gold was found, depicting a Sarmatian horseman with a prisoner. According to this relief oriental armour was influencing much of Europe at the time. Fig. 7 shows a horseman dressed in a fashion that was usual at the turn of the millennium.

During the life of Charlemagne (788 – 814) knee-length shirts of mail, the links being riveted or forged together, were widely used. Leather gaiters were worn around the legs. The short mail shirt or hauberk extended as far as the hip, and was complemented with a pair of armoured trousers. This type of military harness continued into the 12th century. The Bayeux Tapestry, an ancient piece of embroidery having value as a record of the costumes, history and battles of the time, depicts William the Conqueror, who beat the English at Hastings in 1066, wearing a mail garment that covers both body and legs.

This garment is strengthened with square metal plates. Fig. 8 shows two servants bearing away such a suit of armour.



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Chivalry and crusades

At the beginning of the 12th century the hauberk underwent considerable changes. It extended to the calves and was slit up the back or along the sides to fit the saddle better. With a view to reducing weight, horn was often used in place of metal plating. In the middle of the same century, battle experience from the crusades influenced the design and construction of mail to a revolutionary extent. The links, usually of iron, were now welded and riveted. At a later period they were forged in one solid piece. Mail armour, however, was extremely expensive, so many knights contented themselves with leather jerkins adorned with horizontally running iron rings, sewn on with sinews. Strips of leather were then passed through the rings in such a way as to prevent them from flopping about.

At the beginning of the 14th century this type of home-made armour gave way to metal armour that was contoured to the shape

of the body. New smelting techniques had been developed and the craft guilds were in the heyday of their glory. After the English victory over the French at Crecy in 1346, where the English bowmen with their dreaded long bows managed to down all armoured horsemen, it was imperative that new and stouter armour be designed. Improvements in armours were even more urgent when the Italians introduced a crossbow powerful enough to penetrate any suit of armour at near distance with a steel quarrel. Moreover, in 1315 at Mt. Morgarten and in 1386 at Sempach, the Swiss surprised the world by defeating the Austrians (Hapsburg knights on horseback) with halberds.

Although the Swiss victory over the Austrians must have signalized drastic changes in war tactics, conditions remained much the same for the following hundred years. But at least the knights could no longer consider themselves the invulnerable gentlemen of the battle field!

In the first half of the 14th century three or four iron plates used to be riveted vertically to a leather doublet worn over shirt mail, and, similar to the Roman method, up to five flexible horizontal bands protected the stomach and lower chest areas. Arms, leg and knee pieces were, of course, also fitted. A reinforced breastplate to which the sword or dagger was chained, later became the vogue.

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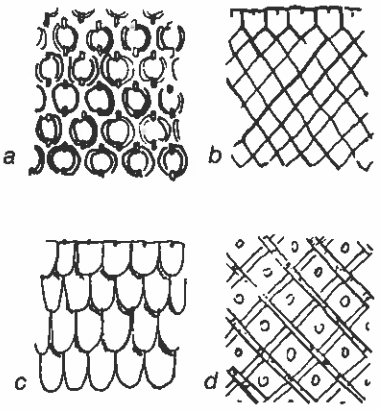

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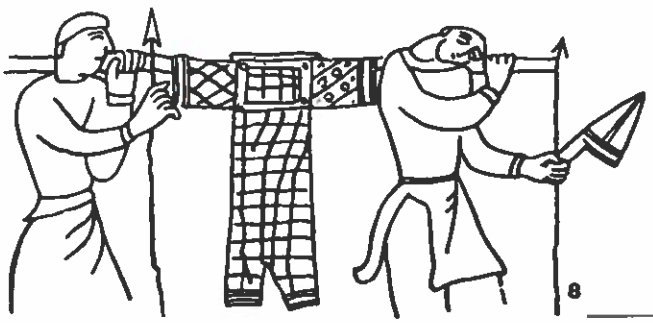

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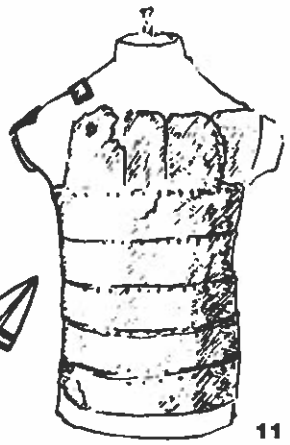
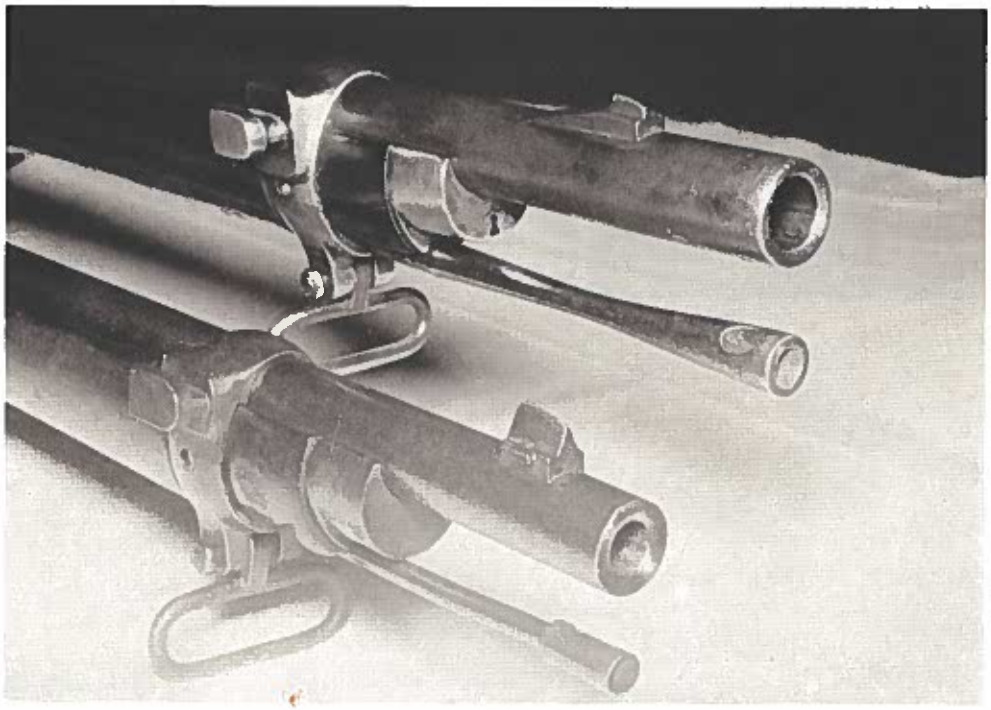


11

portuguese Guedes Model 1885

Text and Photos:
Martin Behrens



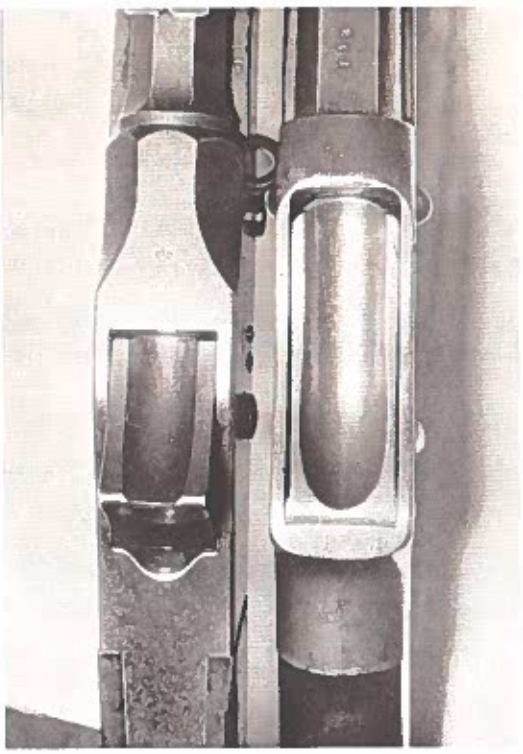
1 *Comparing the English Martini-Henry Mod. 1871 with the Portuguese Guedes. Note strong similarities.*

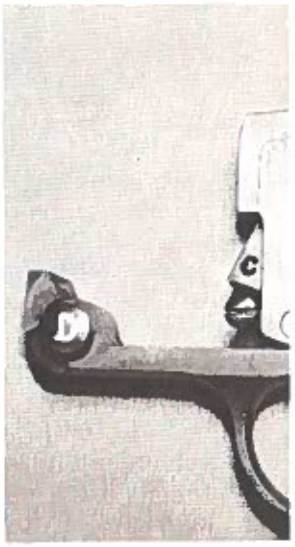
operated rifle was a late comer, and it is well known that stragglers are often very special, though not always in the positive sense. The Guedes was one of these!

In its outward appearance the Guedes largely corresponds to other military rifles of the 70's and 80's of the last century. It has a striking likeness with the English Martini-Henry Mod. 1871. Fig. 1 illustrates the strong similarities between the muzzle section of the Guedes and the Martini-Henry. The middle band is also of similar design. The rear swivel is fastened by the axle bolt of the underlever. Under the elevating sight, which resembles that of the French Mod. 1874, a strong pin runs through the forearm, to the rear of

Technical Data

Overall length:	121 cm
Weight:	4100 g
Barrel:	length 81 cm, 4 grooves with approx. 2 2/3 right-hand twist.
Sights:	Adjustable rear with 5 notches and scale. Blade ramp front sight (with lateral adjustment).
Block:	Semi-pivoting type with inside self-cocking hammer.
Stock:	Lacquered walnut.
Finish:	Furniture and underlever acid grey. Barrel, action housing and block, including screws, blued.





2 *Left Guedes, right Martini-Henry.*
3 *Initials of Ludwig I of Portugal, on right side of housing.*
4 *Underlever operating block.*
5 *Action mounted on wooden board. Rear of receiver represented with piece of wood.*
6 *All lock parts mounted on piece of wood. Hammer cocked.*
7 *Camway on right side of block.*

which a metal eye is anchored (Figs. 2 and 3). The stock is held in place between the top and bottom tangs of the receiver. The cleaning rod is screwed into the forearm.

The action is just as long as that of the Martini-Henry, the odd semi-pivoting block, however, is shorter (Fig. 2). It sticks out of the closed action like a sawtooth roof, giving the Guedes an eye-catching appearance (Figs. 2 and 3).

Action features

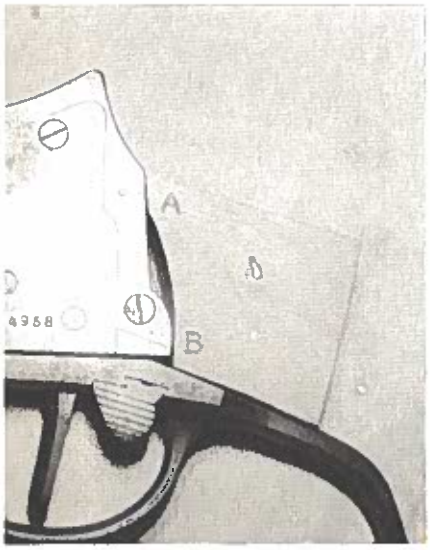
The underlever is connected to the front bottom part of the block via a crossbolt. When the underlever is actuated the block with trigger drops (Fig. 4). When the action is closed the block rests on the underlever (Fig. 5). At its rear the block is supported by the areas A and B (Fig. 5). When the underlever begins to revolve around its axis D (Fig. 5) the block drops in the first instance vertically for about 8 mm. When the block has dropped so far, it

leaves the support areas A and B and, moving backwards, begins a circular motion, the centre of which is the underlever axis D. The curve between A and B causes the initial stage of this circular motion. When the saw-tooth roof of the block hits support area A, the orbital motion is abruptly halted and the block drops vertically about another 5 mm. The shape of the block, the shape of the rear housing with its supporting areas, plus the projection C and screw (Fig. 5), all help to impart the block's various changes of direction. And the camway on the opposite side of the block (Fig. 7) also guides the block through its three – drop, turn, drop – stages. In the block's lowest position the rear, roof-like portion of the loading cavity is parallel with the top receiver tang. The sloping block forms an imaginary extension of the axis of the bore.

It will be obvious to some readers that the Guedes system was an intermediate between the Martini-Henry pivoting block and the Comblain and Sharps falling blocks. Whereas the high rear receiver wall of the Martini-Henry prevents the rifleman from looking down the barrel through the breech, the cutout rear walls of the Guedes, Comblain and Sharps are so low as to even permit the cleaning rod to be inserted from the rear end (Fig. 8).

How the Guedes functions

Hammer, stirrup, hammer spring and trigger are housed in the block, which, on the left side, has a removable dust cover. The short arm of the hammer spring, via the stirrup, tensions the hammer (Fig. 6), the long arm the trigger. Under the face plate, through the round hole of which the hammer pin protrudes, the block is open for the knee (C) of the hammer. When the action is opened this knee comes to rest against a supporting screw (Fig. 5), after the block has fallen and turned in the initial phase. When the underlever is pulled down still further the hammer, via the knee, is cocked against the resistance of the screw. Fig. 6 illustrates how the trigger engages in the detent of the cocked hammer. The Guedes was not provided with a half-cock position, but a sliding trigger safety could be applied (Fig. 9, No. 2). From Fig. 6 one can see how the extractor functions. A push rod (Fig. 9, No. 8) is actuated to operate the extractor plate (Fig. 9, No. 7) via the cam nose of the underlever (in front of axle D). If the underlever is swung down smartly, the spent cartridge case will be hurled clear of the receiver. In other words only three movements were necessary to load the gun: a) operating the underlever to eject spent case and cock hammer, b) inserting the next cartridge, and c) closing the



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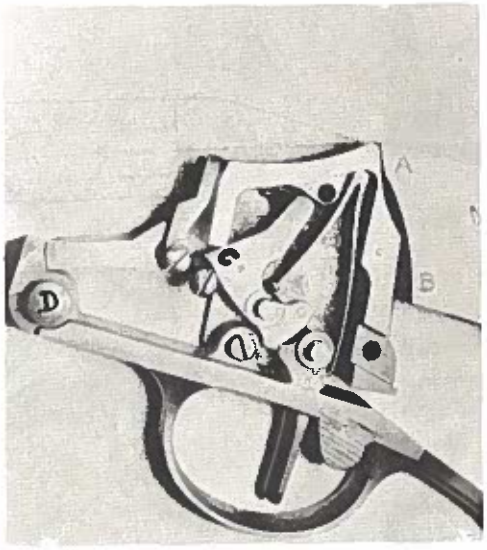

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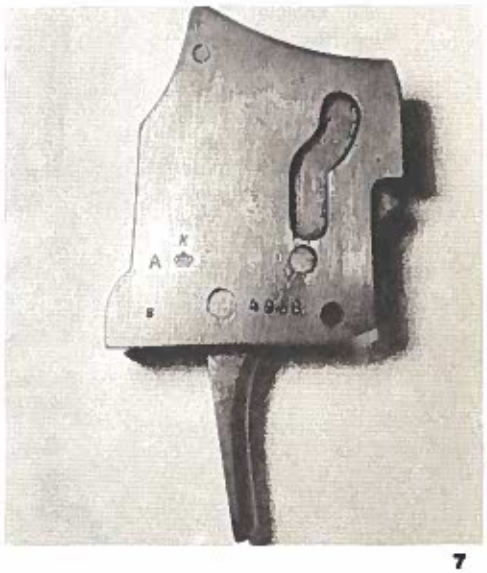

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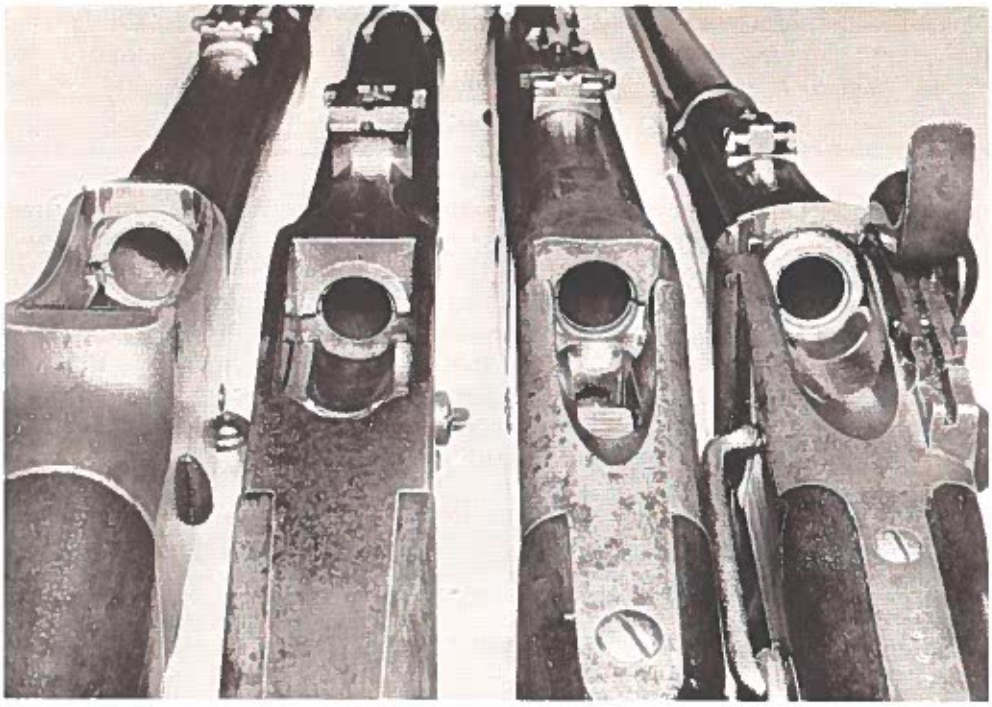
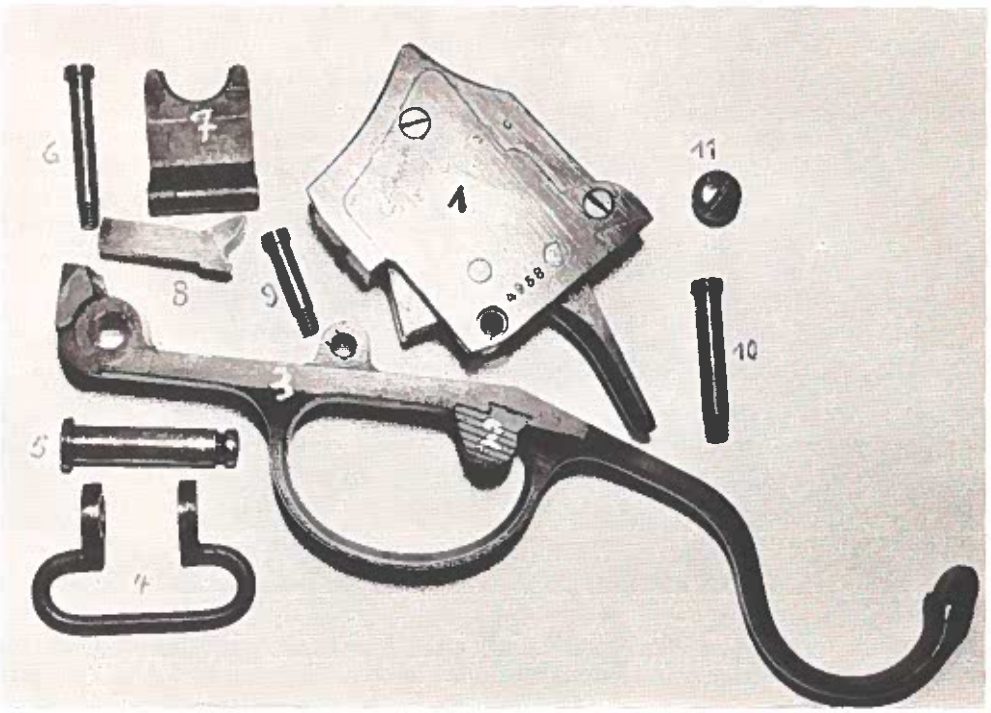


8 *From left to right:*
Martini-Henry Mod. 1871, cal. 11 mm
Portuguese Guedes, cal. 8 mm
Belgian Comblain Mod. 1871, cal. 11 mm
US Sharps New Model 1863/69, cal. .50 – 70



9 *Lock parts:*
1) block which contains hammer mechanism, 2) safety catch, 3) underlever, 4) swivel, 5) underlever bolt, 6) extractor screw, 7) extractor, 8) push rod, 9) underlever and block pin, 10) supporting screw for hammer's knee, 11) guide screw for camway on left-hand side of block.

The portuguese Guedes

action with the underlever.

However, it cannot be said that the Guedes block system had introduced any fundamental novelties in gun construction, nor that it was in any way an improvement on other block-operated military rifles known at the time. The novelty was its 8 mm calibre (8 x 60 R bottleneck, 5 g blackpowder, lead bullet with paper wrapper), making Portugal the first country to reduce its military ammunition in caliber. So-called sub-calibres were being experimented with in the new repeating rifles undergoing development at the time, but it was revolutionary for a single-shot rifle to follow step.

Portugal must have known of these experiments with repeating rifles and decided to utilize weight-saving and space-saving ammunition for her unique block rifle.

For all that, the wind was taken out of Portugal's sails when the Steyr Works in Austria reported that a number of shortcomings in the gun's design had been discovered. After 18,000 Guedes had been produced the Portuguese Ministry of War arranged with the Steyr Works that they complete the remaining order with repeating rifles. The Austrians delivered a model that was principally a Kropatschek, with the Dechambes magazine cut-off, and a Mauser Mod. 71/84. This rifle made a name for itself as the Portuguese Kropatschek. The 18,000 Guedes were not issued to the troops. This explains why the order of the firm of Steyr-Daimler-Puch AG, which detail all transactions since 1876, make no mention of the Portuguese Guedes rifle. The Kropatschek rifles, on the other hand, were entered as follows:

Order from	Quantity	Description	Price
30th Oct., 1885	6000	Kropatschek infantry rifle, 8 mm	frs. 8650.–
30th Oct., 1885	3000	Kropatschek carbine, 8 mm	frs. 7850.–
30th July, 1886	40000	Kropatschek infantry rifle, 8 mm	frs. 8650.–
1st April, 1887	3000	Kropatschek infantry rifle, 8 mm	frs. 8050.–

Assuming these entries to be correct, they show that the Portuguese had placed small orders for Kropatschek repeating rifles before commissioning Steyr to manufacture the Guedes! This would help verify that the Portuguese Ministry of War was of the opinion, at the time, that battle-tested single-shot rifles were preferable to new-fangled repeaters that had not as yet proved their worth.

Model 1885 Rifle

ARMIN SCHECKER

Hiram Stevens Maxim, an American engineer, sold his English patent rights for a machine gun to Vickers in 1883 and, as co-partner, became a director of this company. After purchasing a number of patents for the three-barrelled, hand-operated Nordenfeld machine gun, the Vickers-Maxim-Nordenfeld MG was created, which Maxim offered to the Royal Prussian War Ministry for acceptance trials. The Prussian Armament Testing Commission (GKP) in Spandau started tests in 1889 which lasted 3 years. In 1892 the general staff came up with a crushing verdict: "This machine gun is too complicated for defense purposes, and completely useless for offensive fighting." One might have thought that that put an end to this gun's future in Germany!

The Evolution of the MACHINE

GUN in the German Army

However, two years later Commorell, an English admiral, proved to Kaiser Wilhelm II, during a Scandinavian trip, how well the Vickers-Maxim MG functioned. Kaiser Wilhelm ordered the GPK to reconduct tests with Maxim's machine gun.

The Germans tested all available machine guns. On account of favourable results the firm of Ludwig Loewe, later Deutsche Waffen und Munition, was commissioned in 1894 to construct a Maxim for the German 88 cartridge. This first German Maxim machine gun bore the date 1895, and was exhibited until 1945 in the Hall of Guns at the German Supreme Command Building, when the Russians carried it off as Berlin fell.

By 1897 the Maxim had reached a certain stage in development, and even the German navy retired their Gatlings in favour of the new arms. Reports on the devastating effects of these MGs in the British colonies spurred on further development and soon occasioned all European armies to adopt the machine gun.

The Maxim was used most effectively at Omdurman on September 2, 1898. Lord Kitchener's Anglo-Egyptian army, with their Maxim MGs, wiped out over twenty thousand spear-throwing or muzzle-loader armed Dervishes, with hardly any casualties on the British side. The Germans were so impressed that they decided to adopt this wonderful weapon themselves. The German War Ministry ordered troop trials with 6 companies. To ensure uniform training, the GPK set up a machine-gun course headed by a Captain Rothe, and in early 1899 the first group of

MACHINE GUN

officers and non-commissioned officers attended. Permanent staff were enrolled from the Jaeger Battalions I, 8 and 10, plus the East-Prussian Infantry Regiments 45 and 146. The Jaeger Battalions 8 and 10 distinguished themselves in the 1899 trails.

Owing to experience gained in military exercises, the provisional MG companies, whose limbers were drawn by two horses, were changed into provisional MG detachments, whose limbers were drawn by four horses; an arrangement, after further trails, that was officially inducted to the Prussian army in 1901.

The divisions consisted of 6 MGs and 2 ammunition carts, and were manned by 4 officers, 13 non-commissioned officers, 1 ordnance sergeant and 32 cart and riding horses. During a war the following would be added: a 3rd ammunition cart, 2 carts full of provisions for the combat troops, a reserve MG carriage, and 3 carts for foodstuffs, equipment and baggage. The MG 99's sighting mechanism was so

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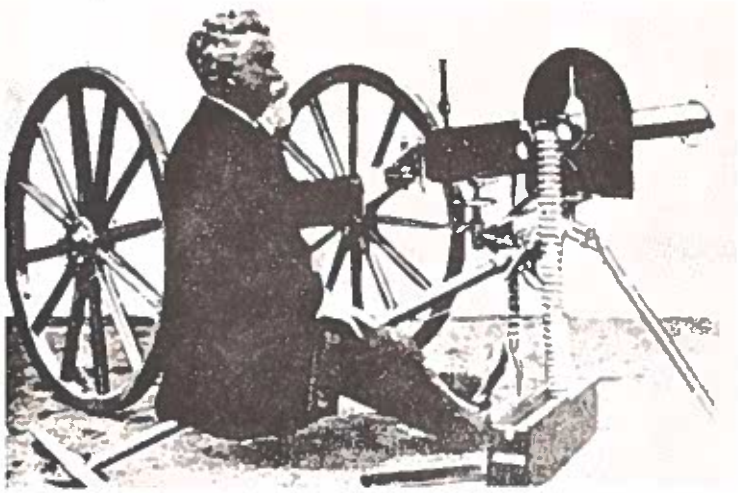

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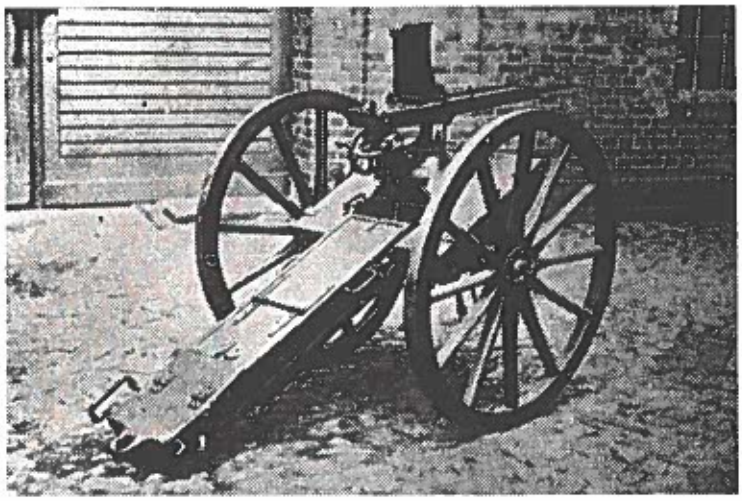

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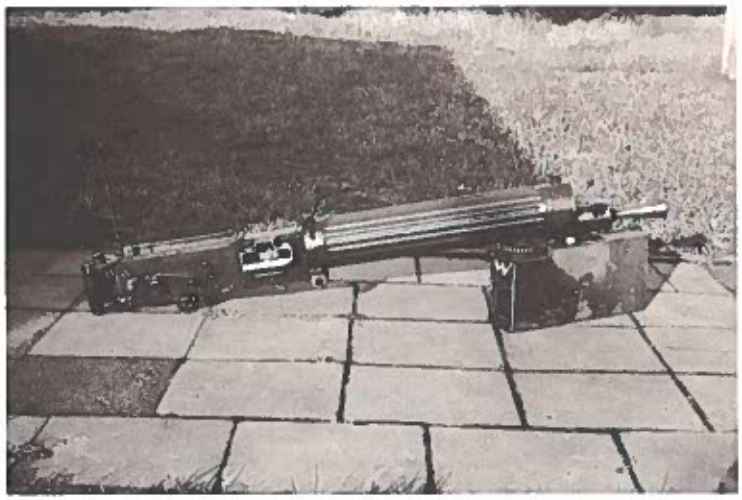

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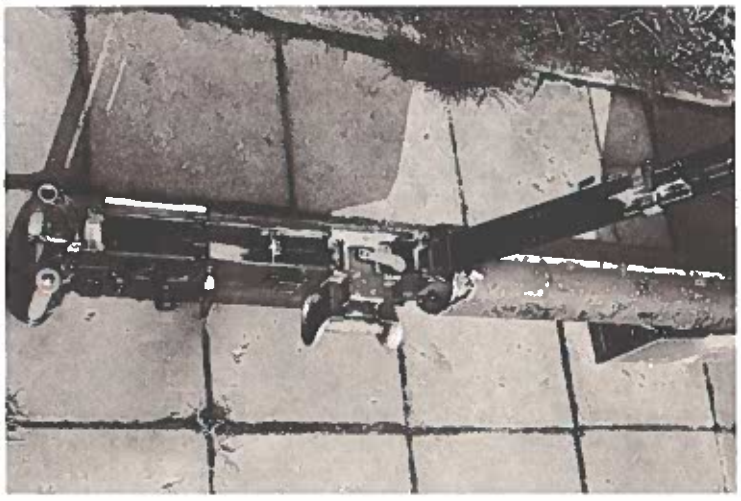

impractical that the whole gun was replaced by the improved MG OI which, though extremely heavy (75 kg), proved very reliable.

In 1903 steel instead of bronze was used for the MG 03. The Russo-Japanese War of 1904/05 was an important event for the further development of the machine gun. The enfilade fire of the Russian MGs in position warfare, a new tactic at that time, especially when the Japanese stormed the 2nd Russian line of fortification at Liaoyang, impressed the Japanese so much that they attached MG units to their infantry divisions and cavalry brigades. Particularly effective was the automatic fire of an MG unit attached to a Japanese cavalry brigade which decimated and drove back a Russian cavalry charge.

Even by itself the death rattle of the machine gun is eerie enough to strike fear into the heart of the bravest soldiers, as has been proved over and over again when panic has spread on the battlefields.

1 *Sir Hiram Stevens Maxim (Feb. 5, 1840-Nov. 24, 1916) sold his English patent rights of 1883 for a machine gun to Vickers.*

2 *Three-barrelled Nordenfeld machine gun, mechanically operated, mounted on English Shut gun carriage. Used by the East-African Wissmann troops in 1889.*

3, 4, 5 *The Vickers Nordenfeld MG of 1889. The gun is of brass and is toggle-lock operated. Apart from actual loading it functions like the Luger, the recoil forcing barrel and breechblock to the rear until the toggle opens. The vertically moving breechblock withdraws a cartridge from the belt. The breechblock runs rearwardly with the cartridge till it is pressed downwards by a spring. On its return journey the cartridge is chambered and the breechblock, being forced up again by spring pressure, readies the next cartridge. The chambered cartridge is then fired. The cycle repeats itself, whereby the spent case is ejected clear of the receiver. The breechblock vertically holds three cartridges: a fresh cartridge taken from the belt, the fired case, and a case to be ejected.*

6 *The Austrian Schwarzlose Machine Gun.*

7 *Vickers Mark I (water cooled).*

8 *The G Rifle Battalion experimenting with limbered machine guns, 1900.*

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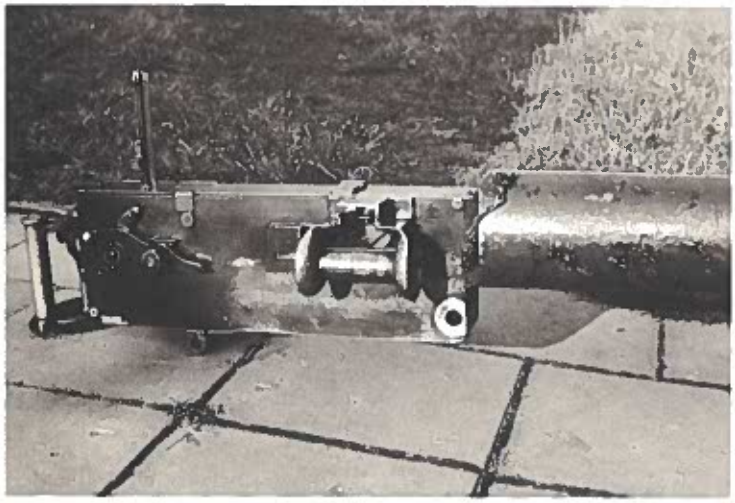

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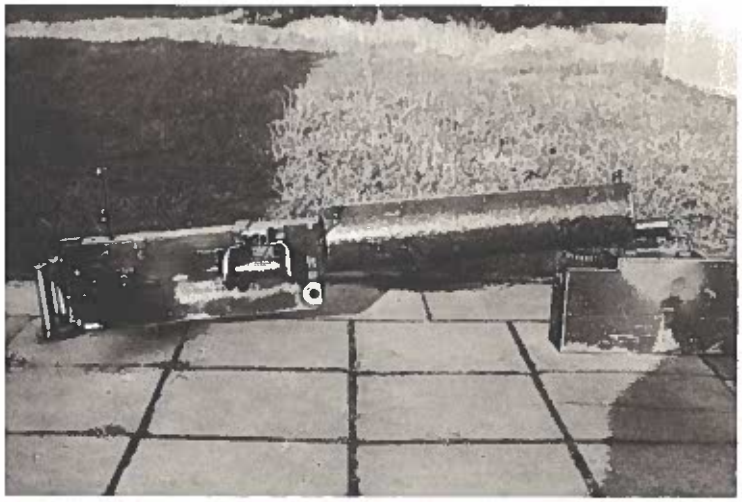

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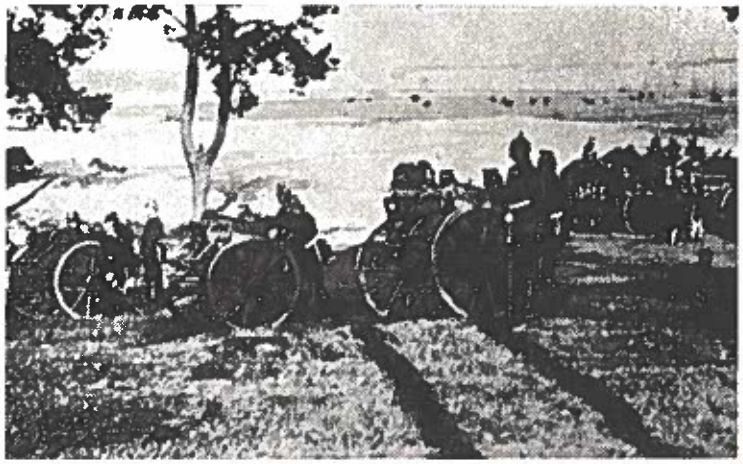

MACHINE GUN

There were no longer any doubts as to the necessity of the machine gun for infantry use. Germany, Russia and England equipped themselves with the moving barrel, recoil-operated Maxim machine gun; the French with a gas-piston machine gun; and the Austrians with a fixed barrel, recoil-operated machine gun. Most of the European states used 4-horse gun carriages for transporting their machine guns. The Germans employed a very heavy, nonetheless very practical, sled mount, whereas other armies used stout tripods. Only the German troops in south-west Africa had tripods. In 1908, the substantially lighter MG 08 was mounted on the 08 folding sled that remained 30 years with the German army.

At the beginning of WWI the Germans had a total of only 3500 MGs. They had no other choice than to "enlist" machine guns made by Dreyse, Bergmann and Madsen plus all the machine guns they could capture from the enemy; providing they fired German ammunition or that sufficient amounts of

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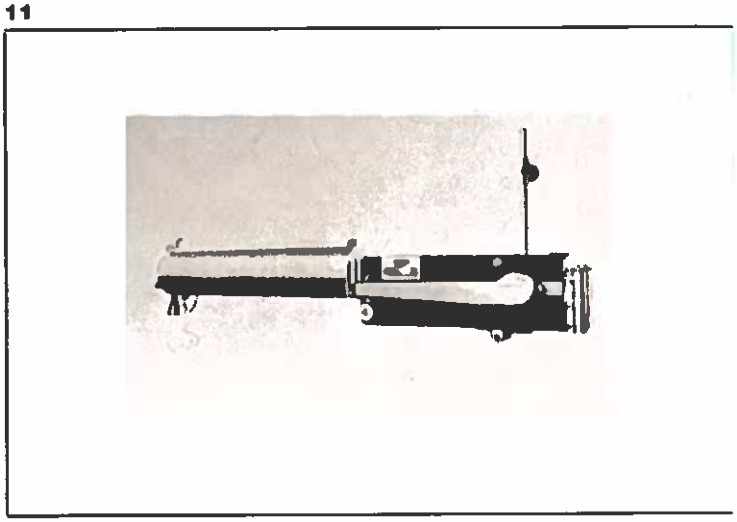

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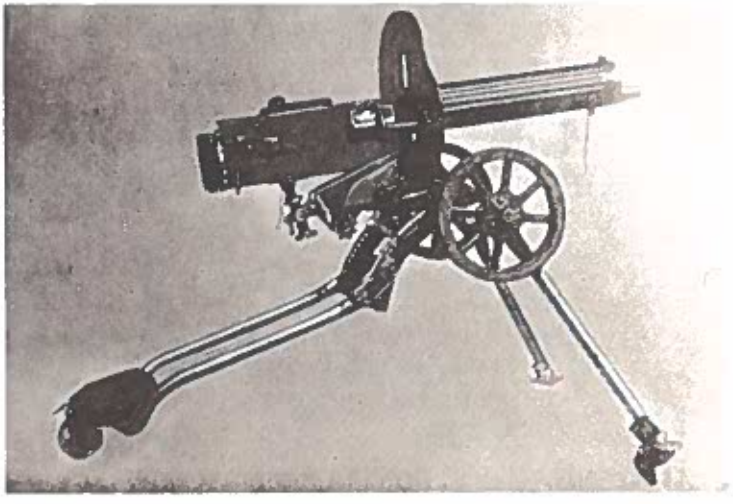

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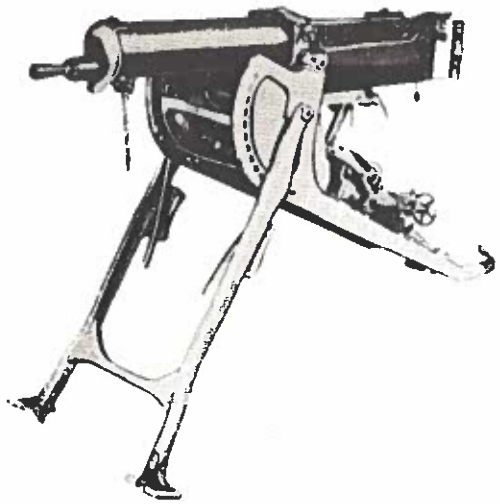

enemy ammunition were available. Despite great difficulties in mass fabrication of the intricate Maxim, by September, 1916, every front-line battalion had an MG company, every cavalry regiment its own MG squadron, and the Supreme Command had at its disposal 86 MG detachments for every 3 companies.

When the English and the French tried to achieve victory at the Somme in 1916 by massing materiel, especially light machine guns, the Germans decided to start mass production of MGs, too. The so-called Hindenburg programme increased the number of MGs manufactured in late 1917 80-fold, compared with the production figures of August, 1914. The Germans decided to mass produce the MG 08/15 (17 kg), an air- cooled gun originally designed for use in aeroplanes.

The normal MG 08 weighed 53 kg. However, in order to equip cavalry troops and cyclists with an ultra light machine gun, the MG 08/18, air cooled and weighing only 12.5 kg, was introduced. The German

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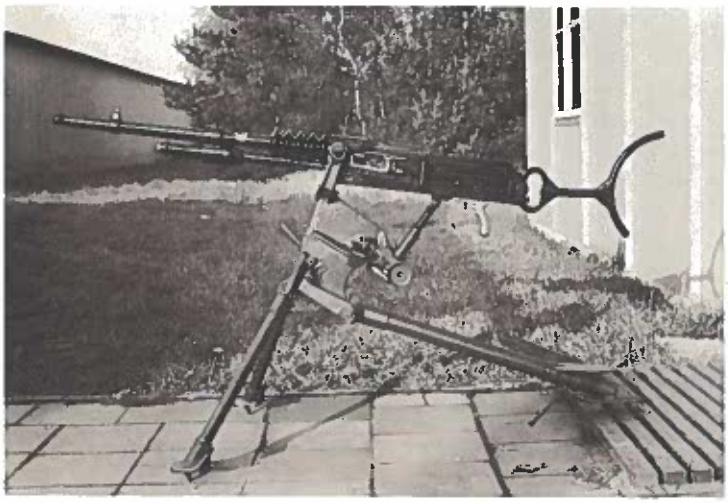

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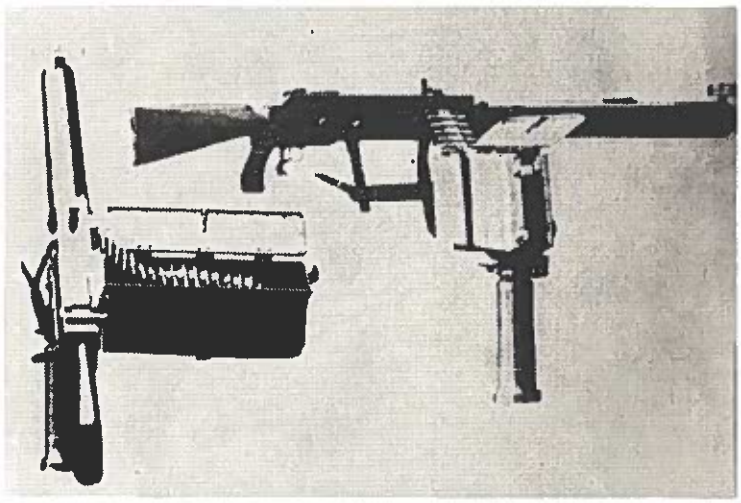

9 *An MG test detachment, the Jaeger Battalion 8, in maneuvers, 1900. Field artillery non-commissioned officers, acting as machine-gun commanders, were replaced by non-commissioned officers of jaeger battalions (1901). Gunsmiths (first MG) were replaced by ordnance men.*

10 *MG cavalry detachment to cover the flanks of the horsemen.*

11 *Maxim-Nordenfeld MG (1889), produced by Vickers.*

12 *Russian Maxim MG*

13 *Maxim MG 08, with accelerator*

14 *Heavy MG 08 being aimed by members of the 2nd Bavarian Jaeger Battalion in the Dolomites during WW I.*

15 *The French Hotchkiss*

16 *The Parabellum MG (1915). This gun was only fitted in zeppelins, since, it was too sensitive to dust and dirt.*

MACHINE GUN

aeroplanes of WWI were fitted with the MG 08 mounted behind the propeller and phased to fire between the revolving blades. The MG 08/15, the second on-board gun, was pivoted to fire at all angles.

At the beginning of the "Battle of France" March 21, 1918, every German Infantry, Jaeger and Pioneer Company had 6 water-cooled MG 08/15s, and every Cavalry, Mountain and Cyclist Unit had heavy MG 08s, and 6 water-cooled MG 08/15s.

In the last year of the war, border guards, ammunition columns, and all other special units were equipped with the heavy MG 08, or with captured MGs. Light MGs, fired from the shoulder, were effective up to about 600 m. The carriage-mounted heavy MGs gave deadly cover fire for the infantry. From behind the lines these heavy machine guns could thwart enemy attempts to break out of their position; the effective range being about 1,200 m. But these guns could also be used up to 3,000 m for harassing fire.

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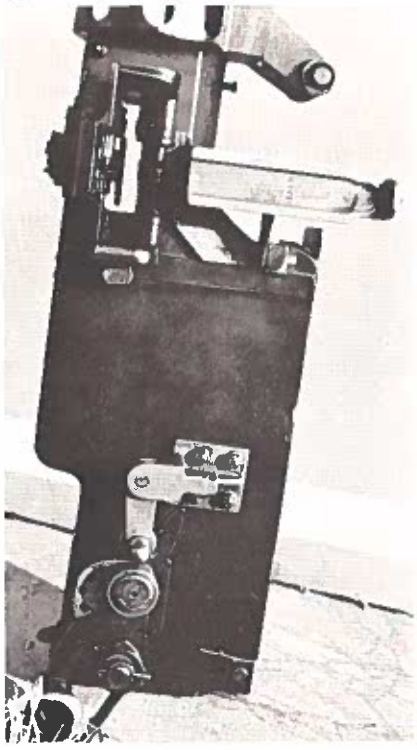

17 *Air-cooled MG 08/ 15*

The Vietcong fought with the Russian Goryunov SG 43 heavy machine gun mounted on a limber. The same gun with cooling fins on a tripod mount is used by the Soviet infantry. The SG 43 was used by the North Koreans as well. **23**

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18 *The Dreyse MG 13, a recoil-operated, straight-line breech-block design.*

19 *A closer look at the MG 13.*
The small trigger within the trigger is for fully automatic fire. On depressing the main trigger only, the gun fires single shots.

20 and 21 *The MG 34. This is a further development of the MG 13. The MG 34 has a rotating bolt head. When firing, the barrel and breech system travel backwards in unison for a short distance, until the bullet has left the barrel. Through a turning motion both sections then disengage. As with other guns, this opening phase accomplished cocking, extraction und ejection of the spent cartridge. The*

During the Battle of the Somme in 1916, the German Supreme Command ordered that all participants of Major Altrock's machine-gun course in Döberitz should be entrained to France with their MGs as quickly as possible. They were on their way within a couple of hours, for the Germans were fearing another French break-through, similar to the one in September, 1914, when Paris taxis drove MG-armed soldiers to the Battle of the Marne.

In time, war experience showed that a machine gun is only war worthy when it can be simply and inexpensively mass produced.

The Maxim MGs, with all their intricate parts, were not suitable for modern production methods. Despite the fantastic increase in MG production (1916: 21,595 MGs a year, 1918: 133,092 a year) the Germans realized that a new MG would have to be introduced.

The Dreyse MG, a recoil operated, straight-line breechblock design, seemed to be very suitable for mass production. After many years of testing and redesigning the Dreyse was tentatively adopted in 1931 as the MG 13. However, it was soon replaced by the MG 34.

In WW II the MG 34 bore the brunt of the fighting, alongside the veterans MG 08 and MG 08/15. But the MG 42, which appeared 3 years after the outbreak of war, was the first great step forward in machine gun technology. The MG 42 could be used as a rifle or a machine gun, and was by far the most modern small arm of the war. With a cyclic rate of 1,200 shots a minute, the effectiveness of this gun was devastating. Even today the MG 42 can hardly be improved on, and the post-war German Army has adopted it as its official light machine gun which, with some changes, is now known as the MG 3.

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return movement of the bolt under spring pressure reloaded the chamber. However, the MG 34 was very susceptible to foreign matter and changes in temperature.

22 *The MG 42. This is one of the most reliable machine guns ever produced anywhere. It is recoil-operated with a moving barrel, but not very sensitive to dirt and changing temperatures. The bolt does not revolve to lock. Two metal balls in the bolthead keep the action locked when firing. The muzzle recoil booster accelerates barrel and breech assembly backwards, about 8 mm, whereby the locking metal balls are pressed out of their receiver-wall recesses. Otherwise as the MG 34.*

TEXT AND PHOTOS BY MARTIN BEHRENS

Here progress seems to have really been in full swing; for the Norwegians decided, in 1840, to equip their armed forces with breechloaders at a time when all the great armies of Europe were still shouldering muzzle loaders. This might partly be attributed to the fact that the Norwegians only had an army of 12,000 men and that their task was purely defensive; upheld by a number of forts throughout the country. Still, the Norwegian rifle was ahead of its time. As no other country had had sufficient experience with breechloaders, the Norwegians had definitely broken new ground.

In 1814 Norway agreed to unite with Sweden under one king, once the constitutional law guaranteed Norway her total independence with her own army, navy, national bank, monetary system, customs and exise, and university; in fact everything considered necessary for a self-governed country. In the following 50 years Norway climbed the economic ladder: Industry grew by leaps and bounds, modern roads were built and steamships plied the coasts. In 1854 the first railway ran between Christiania (today Oslo) and Eidsvold, the tonnage of the merchant navy increased and trade was conducted with the mighty British Empire by virtue of the Navigation Acts. The spirit of progress and a strong feeling for independence arose in the Norwegians, as Sweden emphasized her power whenever she could. This friction seems to have influenced Norway's army, too.

On the other hand, the tip-up chamber principle was not exactly new; for the Austrians had, a number of years before, conducted extensive tests with their Crespi tip-up chamber and Hall of America had already introduced a similar weapon in 1819. Baker of England also made a few models resembling the Hall and in 1831 France came up with a breech-loading wall gun.

The loading principle

To prevent, as far as possible, gas leaking from a tip-up or removable chamber, the face of said chamber was provided with a lip that fitted into the rear of the barrel. This design necessitated, of course, not only an upward, but also a rearward movement, to free the lip from the barrel recess. To achieve this end, the chamber was housed on a slide which could be locked in the forward position when the gun was ready to fire. Both the French and Belgian models work on this principle and the Belgian even had a removable chamber block (Fig. 1). For military purposes, however, withdrawing and lifting the block should be accomplished in one movement. The Norwe-

The Norwegian Rifle

with Tip-Up Chamber

gian tip-up model of 1842 was constructed with this important feature.

The chamber

The barrel extension has two side walls (Fig. 2) and a narrow opening in the floor, into which two dovetailed sections are fitted. A block concave at one side, is firmly positioned at the rear via two pairs of side screws and two bottom screws. The chamber, 9.7 cm in length, rests in this cavity. When in the prone position the chamber lies flush with the top of the receiver. The front lip measures 4 mm, and acts as a mechanical seal when forced into the rear section of the barrel. A lever mounted on the right-hand side of the rifle is connected to an eccentric crosspiece, which in turn passes through the rear of said chamber.

When the chamber rests parallel in the receiver, the

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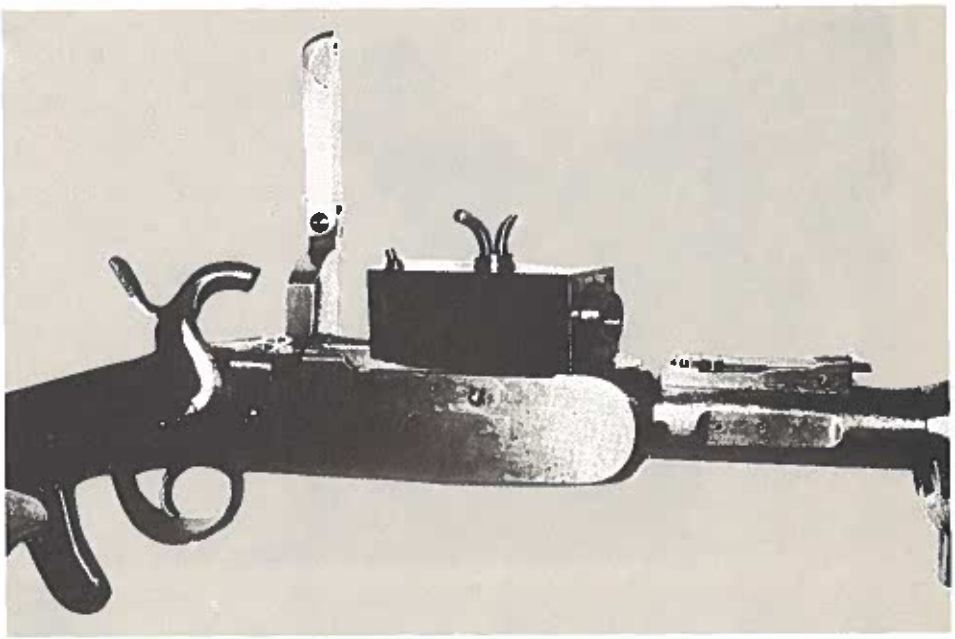

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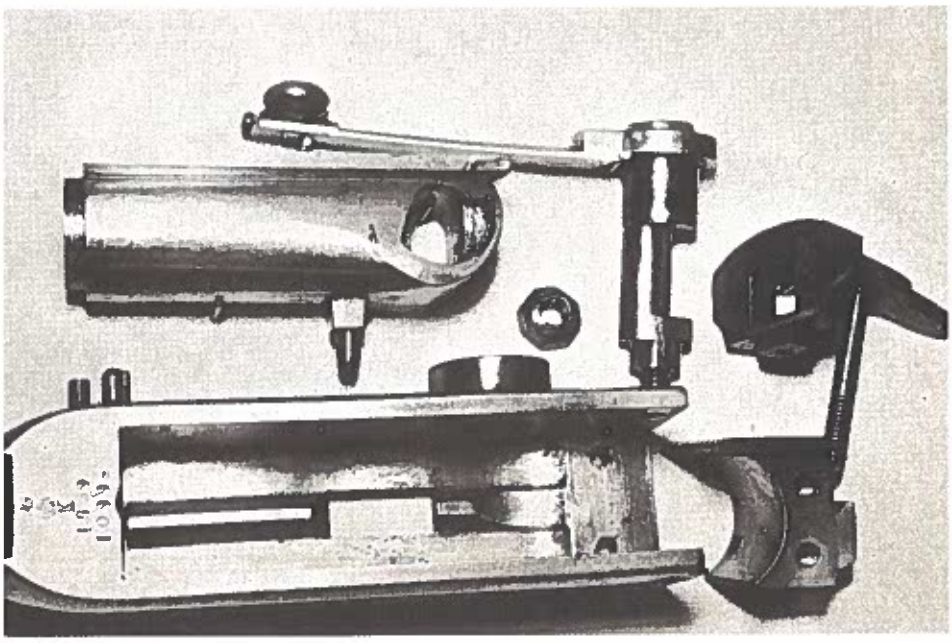

1 *Wall gun, chamber removed.*
2 *Parts of the Norwegian tip-up-chamber rifle, l.t.r.: chamber, eccentric crosspiece with lever, breech tail piece with tang screw, barrel extension, rear block with tongue to fit the tail piece.*

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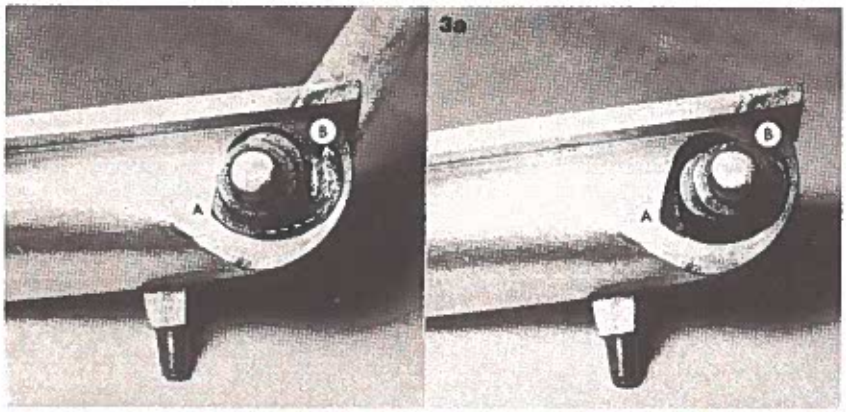

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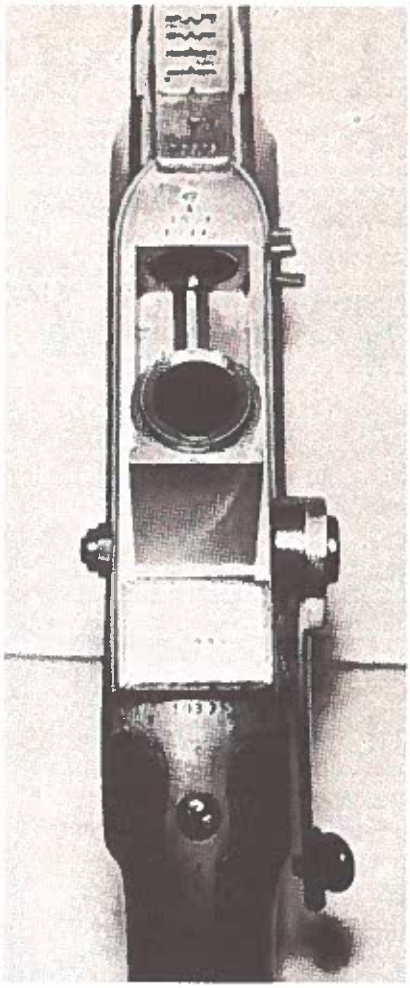

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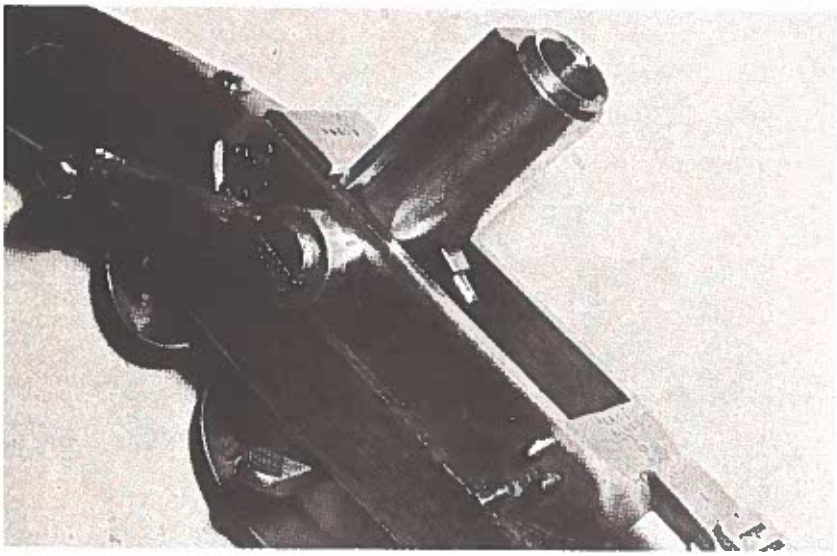

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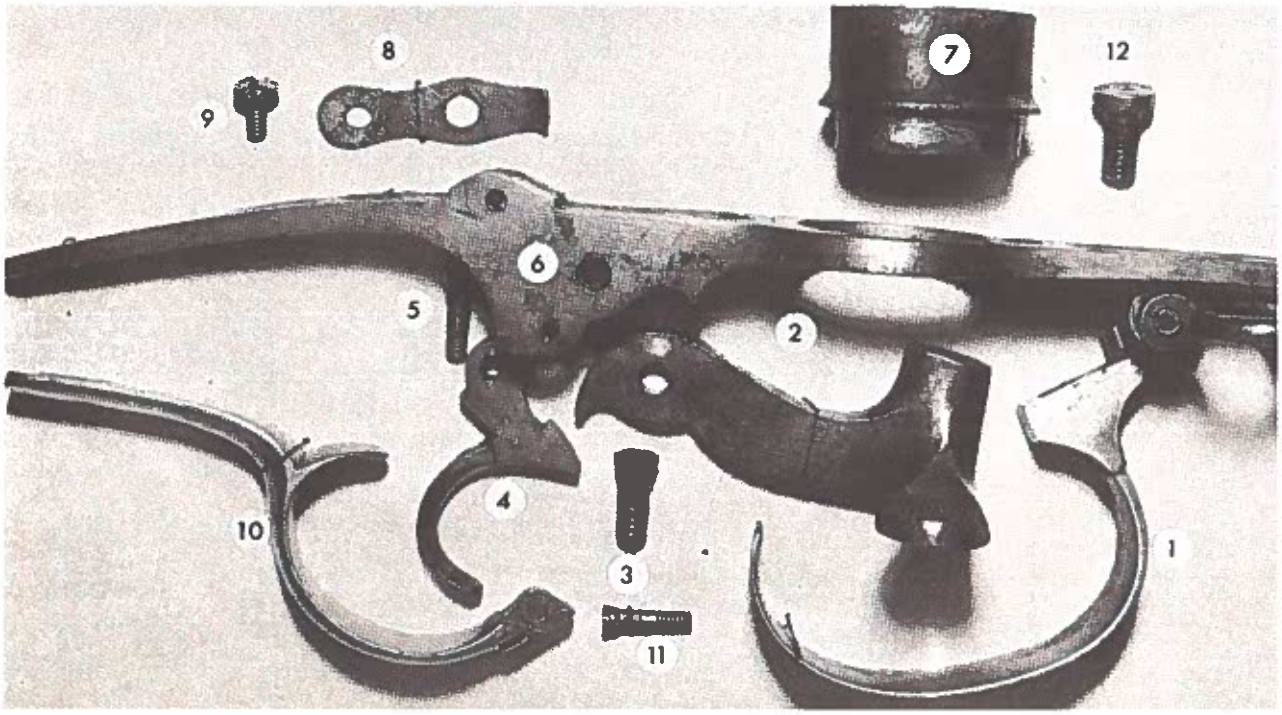

lever knob is held by three pins that are situated on the right-hand side of the frame (see illus.). In this position the eccentric crosspiece forces the front lip of the chamber into the recess of the barrel. When the lever is lifted the eccentric crosspiece withdraws the chamber from the barrel recess before raising it to the vertical. Fig. 3 illustrates the camway of the chamber which the crosspiece has to follow, imparting both a reaward and lifting movement on its way.

Neither the eccentric crosspiece nor the camway closes the chamber, as is claimed by Thierbach in "Die geschichtliche Entwicklung der Handfeuerwaffen", and by Mattenheimer in "Die Rückladungsgewehre 1867 – 1869". This must be clear to all when studying Fig. 3.

With the chamber in the vertical position the cam of the eccentric crosspiece can rotate from A to B (a complete half cycle) without influencing the chamber in any way. This "freeway" is necessary, otherwise the chamber could not move in the horizontal. If the lever is pushed forward while the chamber is in the vertical, the eccentric crosspiece does not drop the chamber until after it has lifted it (pushed it forward). This can best be appreciated when trying to close the chamber when the muzzle of the gun is pointing upwards. The front lip of the chamber strikes the rear section of the barrel. In other words, when the gun is held vertical the chamber must be pressed down with one's thumb and then forced into the barrel recess by turning the lever forward. On the other hand, when the gun is horizontal the lever need only be pushed out of the loading position to let the chamber drop under its own weight. During this turning motion the cam of the crosspiece forces the chamber horizontally into the barrel recess. This interaction is so perfect that one is under the illusion that the lever actively controls the chamber's dropping and locking.

The joint between the chamber and the barrel works well, but this method does not seal off the breech completely, as will be verified when using strong loads. Mattenheimer is of the opinion that the lip of the chamber functions as an obturator, and expands when the gun is fired. Seeing that the lip has a cross section of 2.75 mm, and the chamber a cross section of 5.6 mm, that cannot be the case. The diameter of the loading cavity is 18.7 mm. The bore of the barrel, across the lands, measures 16.8 mm, across the grooves, 18 mm.

The first projectile used in this rifle was a round ball, but this was superseded by a massive pointed bullet with two cannelures. Thierbach claims that 4.5 g of powder was used. However, in view of the cavity depth of 6 cm, one might suppose that more powder could be loaded, if necessary.

Lockwork

Owing to the tip-up chamber construction, the hammer is mounted on the underside of the rifle to strike the nipple that protrudes from the bottom of said chamber. This principle was not new either. In the 18th century a few flintlocks put in an apearance with this underhammer system, as did the percussion rifle by Whitelock during the 1830s. The design of the Norwegian lock is truly simple, see Figs. 6 and 7. The hammer is pivoted in front of the trigger, and its spring is shaped like a forward trigger guard. When the hammer is cocked its rear detent engages in the bent of the trigger. There is no half cock position. The round hole in the centre of the trigger plate permits the hammer to reach the nipple. However, the hammer does not rest on the nipple, as in normal percussion locks. The path of the striking hammer has been so designed that it just reaches the percussion cap, not the nipple itself.

When the chamber is in the closed position, the nipple is shrouded by a brass insert, and does not protrude out of the rifle. In other words the explosion of the cap takes place within the body of the rifle. It was not necessary to hollow out the striking surface of the hammer to prevent fragments of the cap from flying in all directions, as this safety precaution was accomplished by the housing of the rifle. The gun could be put on safe by in-

3 *The head of the eccentric crosspiece engages with shoulder A to lift chamber.*
3a *Position of eccentric crosspiece when chamber is closed.*
4 *Chamber ready to be loaded.*
5 *Top view of Mod. 59 with open chamber.*
6 *1) Hammer spring*
2) Hammer
3) Hammer screw
4) Trigger
5) Trigger screw
6) Trigger plate
7) Brass nipple housing
8) Spring
9) Spring screw
10) Trigger guard
11) Front trigger guard screw
12) Tensioning screw for hammer spring.

The Norwegian Rifle with Tip-Up Chamber

serting a leather-bound pin, which was tucked away in the shaft above the hammer spring, in a hole between hammer and trigger plate. Since the nipple hung vertically from the chamber, extra tight-fitting caps had to be used so that they would not fall off again. This was probably the reason why, in Sweden, a Lieut. Frjlitzen and an armourer of the name of Hagström placed the nipple on top, and fitted a sidelock, too.

Gun and accessories

As seen in Fig. 2 the barrel, via the barrel extension, locks into a sort of breech tail piece, the tang of which is inlet into the stock and held by two screws. In addition to this rear fastening, two, sometimes three, bands hold the barrel firmly to the forearm. In some models the bayonet socket is situated on the right just behind the muzzle. There is no provision for carrying a ram or cleaning rod. The front swivel is at the tip of the forearm, the rear in front of the hammer spring. For collectors it might be of interest to describe a few of the various models that appeared over the years. These deviations are listed in the 1949/50 booklet issued by Army Museum in Oslo, titled: Haerens handvapen, gevaerer og karabiner 1814 – 1940, by Nielsen and Skaar.

Other models

The 1842 model had a total length of 142 cm, a barrel of 93.2 cm, and a rear sight that was very near the eye of the rifleman. This model was equipped with a Dillon bayonet sporting a spring-bolt lock. The only difference between the 1842 and the 1846 models was that the latter had a bayonet with an angular slit running down the handle, and a safety ring. The 1848 model for the officers' academy was sometimes 31 cm, sometimes 19 cm and sometimes 5 cm shorter than the previous version. The 1849 model had a tangent, double-flap rear sight, and a special sniper sight at the rear of the barrel. In the 1855 model the rear sight was mounted on a ring that encompassed the barrel. It had an extra flap for 4 ranges. The 1859 model also had this sight, but a barrel of only 77 cm with two bands. A sabre-type bayonet of 57 cm was introduced as well (Fig. 9), which resembled the yataghan of the Chasseurs d'Orléans (1840, France). Many an old model was shortened to the length of the M 1859, or re-equipped with the modern rear sight. In 1860 an 1846-type model appeared, which also had the Dillon bayonet, but which was chambered for an 11.77 cm cartridge. Another 1860 model resembled that of 1859, but was calibrated for the new cartridge. Only 12,000 of these two 1860 models were produced. A special marksman model also appeard in 1860 with iron furniture. A cavalry carbine in cal. 12.55 mm was introduced in 1857 with a 46.6 cm barrel, saddle ring, two brass barrel bands. An artillery carbine appeared between 1862 and 1866 with a 44.4 cm barrel and socket for sabre bayonet. No saddle ring was provided. The forearm ended about 13 cm before the muzzle, similar to M 1857. The 1865 cavalry carbine resembled the artillery model of 1862/66 but was chambered for the lighter 11.77 mm cartridge. It did not have the socket for the bayonet.

Most of the rifles were manufactured at the government plant at Kongsberg, hence they bear a K and a crown. Kongsberg has remained the sole gun factory of Norway. Some of these guns were made under licence by De L'Etat at Liege (Belgium), August Francotte of Liege, and by Crause of Herzberg (Germany) who was a famous purveyor to the Royal Hanoverian Army. Outside Norway 1,500 of the M 1846s and 2,000 of the M 1849s were manufactured, bearing the stamps "C.H." or "R."

Changing over to the metallic cartridge

When the metallic cartridge was developed, Norway was quick to react. In 1867 about 1000 rifles were converted to accept a large-calibre, rim-fire cartridge with copper case (Lund). The tip-up chamber was replaced by a housing containing a striker; an ex-

tractor was mounted on the left-hand side, and the receiver was opened up on the right to facilitate loading. However, everyone realized that such conversions could only be stopgaps. Hence, in the same year a Remington breechloader was adopted, chambered for the rim-fire cartridge 12.17x44 R. The M 1860s, chambered for the 11.77 mm, were then converted to the Lund system. Originally, the Norwegians thought they would have to rebore the barrels to accept the American ammunition, but this did not prove necessary, since the 12.77 mm rounds fitted without anything having to be changed. The 11.77 carbines were likewise converted for the metallic cartridge.

The Norwegian tip-up chamber rifle never did see active service. When the German troops in 1848 were on the verge of overrunning Denmark, the Swedes and the Norwegians under Oskar I deemed it neighbourly to grant little Denmark some military aid. But at the last moment help was not sent. When in 1864 the Sleswig-Holstein issue came to a head again, Karl XV decided to protect Denmark from Germany, but a representation of the people would have none of it!

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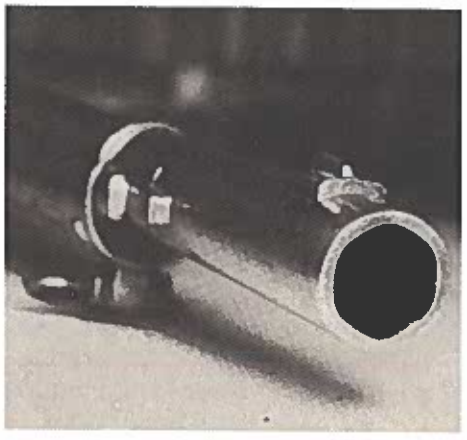

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7 *Complete trigger-plate assembly, hammer cocked.*
8 *Right-hand view. Breech locked, hammer cocked.*
9 *M 1859 bayonet.*
10 *Muzzle of M 1859.*

Technical data of M 1859

Total length	*(without bayonet): 126 cm*
Weight:	*4925 g*
Barrel:	*77 cm*
Bore	*across land: 16.8 mm* *across grooves: 18 mm*
Twist:	*Right hand*
Sights:	*Tangent, adjustable 300–800 m,* *Side-mounted front bead (brass)*
Breech:	*Tip-up chamber*
Lockwork:	*Mechanism and nipple on underside*
Stock:	*Lacquered walnut*
Furniture:	*Brass, including trigger guard*

Text and Photos: Dr. Spangenberg

The Rheinmetall Automatic Shotgun No.4

When, after the first World War, the German armaments industry was out of work, attempts were made to get a grip on the commercial markets. Rheinmetall, like Walther, started on an automatic shotgun design, believing experience gathered in the fabrication of machine guns could be put to good use.

1 Left-hand view of the No. 4

Data on development and output are no longer available. This and other information was destroyed in WW 2 and the old designers and technicians are no longer in Rheinmetall's employ. It may be readily assumed that not many of these shotguns were made; today it is a rara avis, owing to the fact that many such guns were destroyed after the war.

At this point I wish to express my gratitude to Rheinmetall for kindly lending me a No. 4 shotgun which they had just repurchased for their own museum. Unfortunately, the gun was not in perfect order, some of the parts were missing or looked as though they had been replaced by a village blacksmith. In this article I make mention of my own repairs and fittings to this gun so that my readers, those owning a Rheinmetall shotgun, can contact me with any additional information they wish to proffer.

Technical data

The shotgun under review (16/65 gauge) is illustrated in Figs. 1 and 2. It weighs 3.26 kg. Weights of parts are listed in Table I. Its overall length is 118 cm, barrel 70 cm. The tube magazine is in the forearm and holds 4 shells. The breechblock consists of two parts and is locked by rotation. The rocker type safety catch lies behind the trigger, which it blocks when actuated.

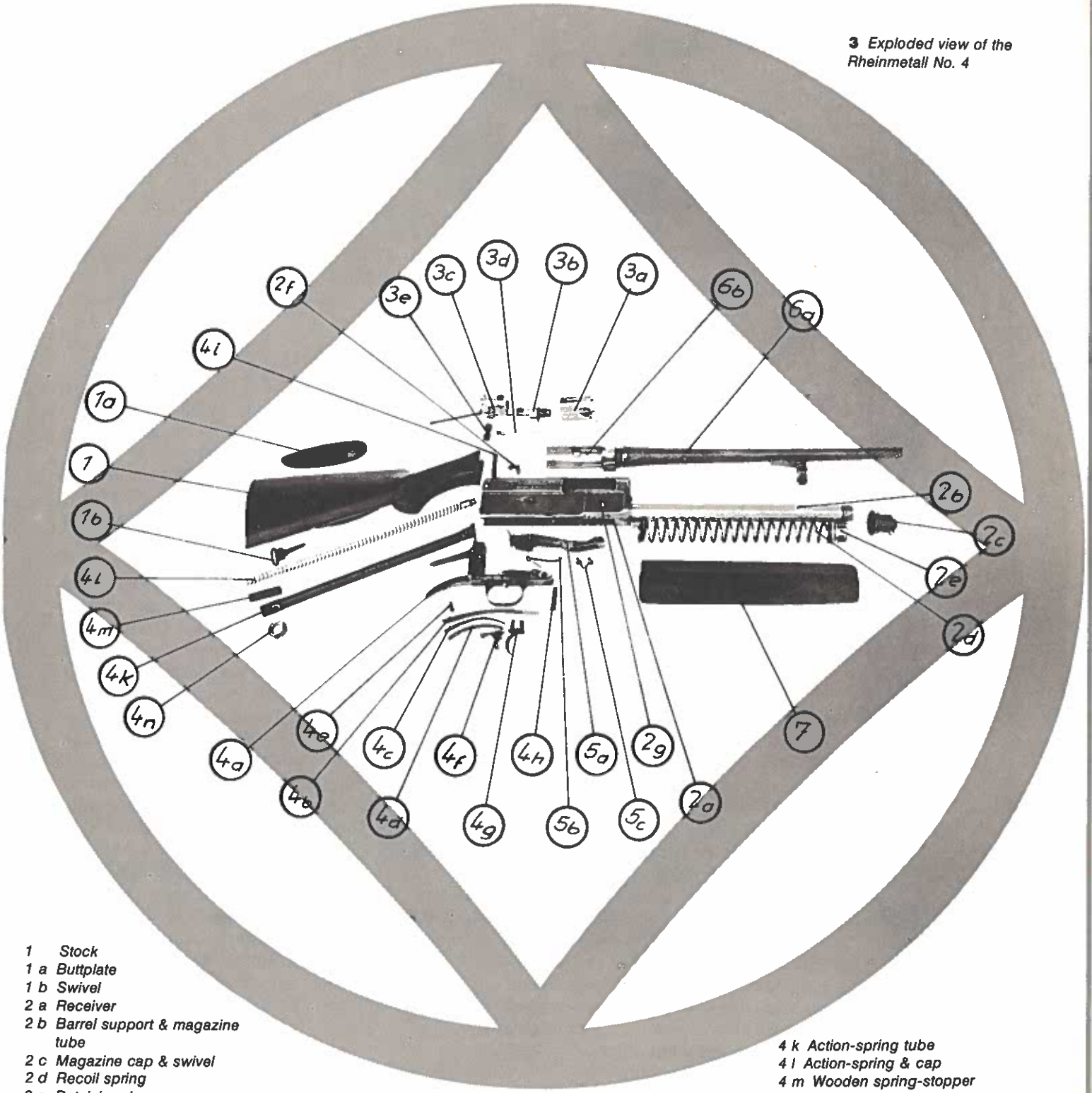
The barrel has the following stampings:

First provisional proof (eagle) Choke (crown with W)
Second provisional proof (eagle, crown and U)
Smokeless powder proof (Nitro with eagle)

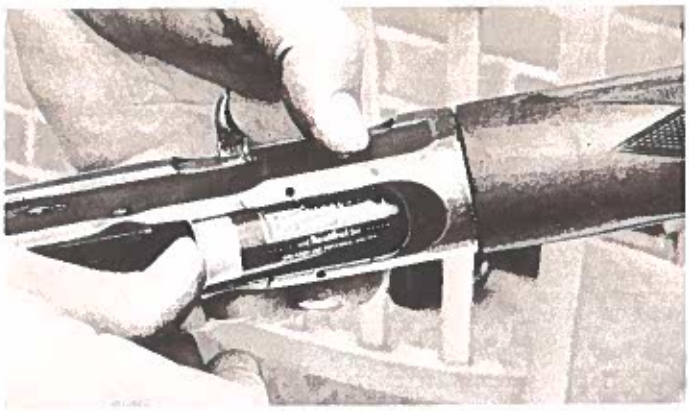
This gun also bears the name Rheinmetall, the number (2131), and the inspector's number.

2 Right-hand view of the No. 4

3 *Exploded view of the Rheinmetall No. 4*



1 Stock
1 a Buttplate
1 b Swivel
2 a Receiver
2 b Barrel support & magazine tube
2 c Magazine cap & swivel
2 d Recoil spring
2 e Retaining ring
2 f Cut-off
2 g Breechblock stop & release
3 a Breechblock head & extractors
3 b Locking block
3 c Breechblock tail & spring guide
3 d Striker
3 e Cocking handle
4 a Trigger plate & hammer
4 b Hammer spring
4 c Trigger spring
4 d Safety spring
4 e Retaining screws for springs
4 b – 4 d
4 f Safety catch
4 g Trigger
4 h Bottom trigger-plate screw
4 i Top trigger-plate screw
4 k Action-spring tube
4 l Action-spring & cap
4 m Wooden spring-stopper
4 n Stock retaining nut
5 a Carrier with dog
5 b Carrier spring
5 c Left and right carrier screws
6 a Barrel & barrel ring
6 b Barrel extension with ejectors
7 Forearm



4 *Loading the magazine by depressing the release button*

Operating

To load, pull breechblock back until it remains open, then push first shell through the ejection port on to the carrier. Upon depressing the release button (2 g) the breechblock slams home, chambers the shell and locks the action. By keeping your thumb on the release button (2 g) 4 shells can be fed into the magazine (Fig. 4). Of course, the magazine can be filled first, whereby the breechblock must always return to the home position. By cocking, the first shell will then be loaded into the chamber. The danger here, however, is that front and back sections of the breechblock, owing to the pressure exerted by the magazine spring, will not separate far enough to engage in the spacer. The spacer can get stuck at the rear of the chamber. By pulling back hard on the breechblock the spacer can be made to engage, whereby the breechblock then closes properly and locks. The gun can now be fired.

The gun

Seeing the No. 4 for the first time might lead one to believe that it is a copy of the Browning Automatic Shotgun. Although the similarities cannot be overlooked, on closer inspection quite a number of Rheinmetall features will be discovered.

Parts of similarity between the new FNs and the No. 4 will be marked with a B. Of course, it is open to conjecture whether the new FNs did not sometimes draw their inspiration from the Rheinmetall gun!

Fig. 3 shows the gun stripped, and each part is marked with a number and a letter of the alphabet. Hence each part can be attached to one of the following main groups:

1. Stock
2. Action housing
3. Breechblock assembly
4. Recoil spring and trigger assembly
5. Carrier
6. Barrel
7. Forearm

1. The stock is longitudinally bored to accept the spring-carrier tube (4 k), the lower end of which is threaded. The stock retaining nut (4 n) locks the spring-carrier tube to the receiver. (A special socket wrench with two front end projections is needed to take down the stock.)

2. The receiver (2 a) bears much resemblance to that of the Browning. The main difference being that the Rheinmetall receiver has an opening at the bottom for the trigger-plate assembly (4 a). The inside top section of the receiver is grooved to accept the barrel and the sliding breechblock with cocking handle (B). The ejection port is situated on the right-hand side of the receiver. The tube magazine (2 b), attached to the receiver, supports the barrel (6 a), the recoil spring (2 d) and forearm (7) (B).

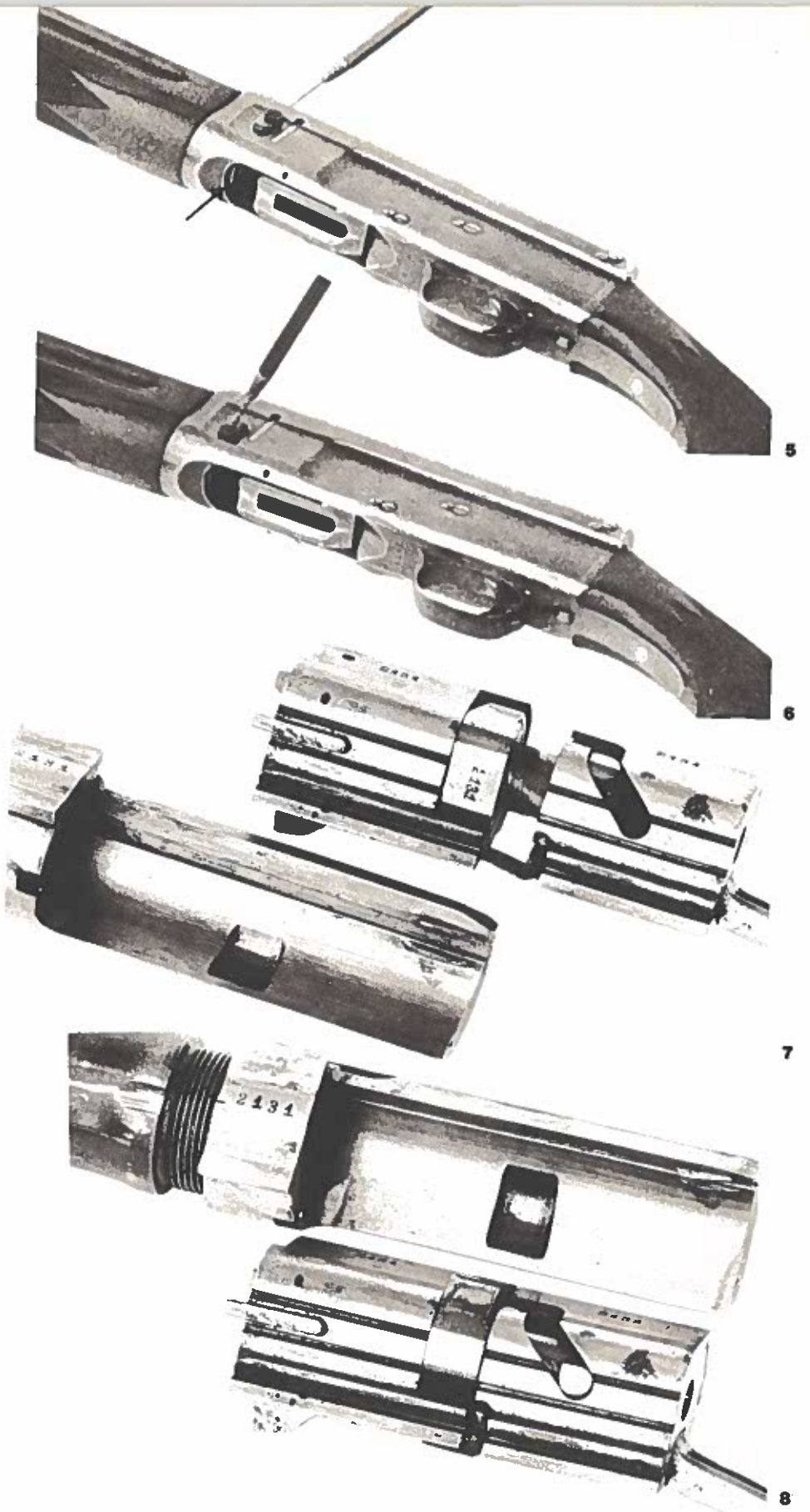
On the right-hand side of the housing is the breechblock stop with its release button (2 g) (B). On the left-hand side is the shell stop (B) which is reg-

5 *The cut-off "out of action" – head of shell can be seen.*

6 *The cut-off "in action" – shell is depressed and cannot leave magazine.*

7 *Breechblock and barrel extension. Head and tail sections of breechblock held by spacer link in open position.*

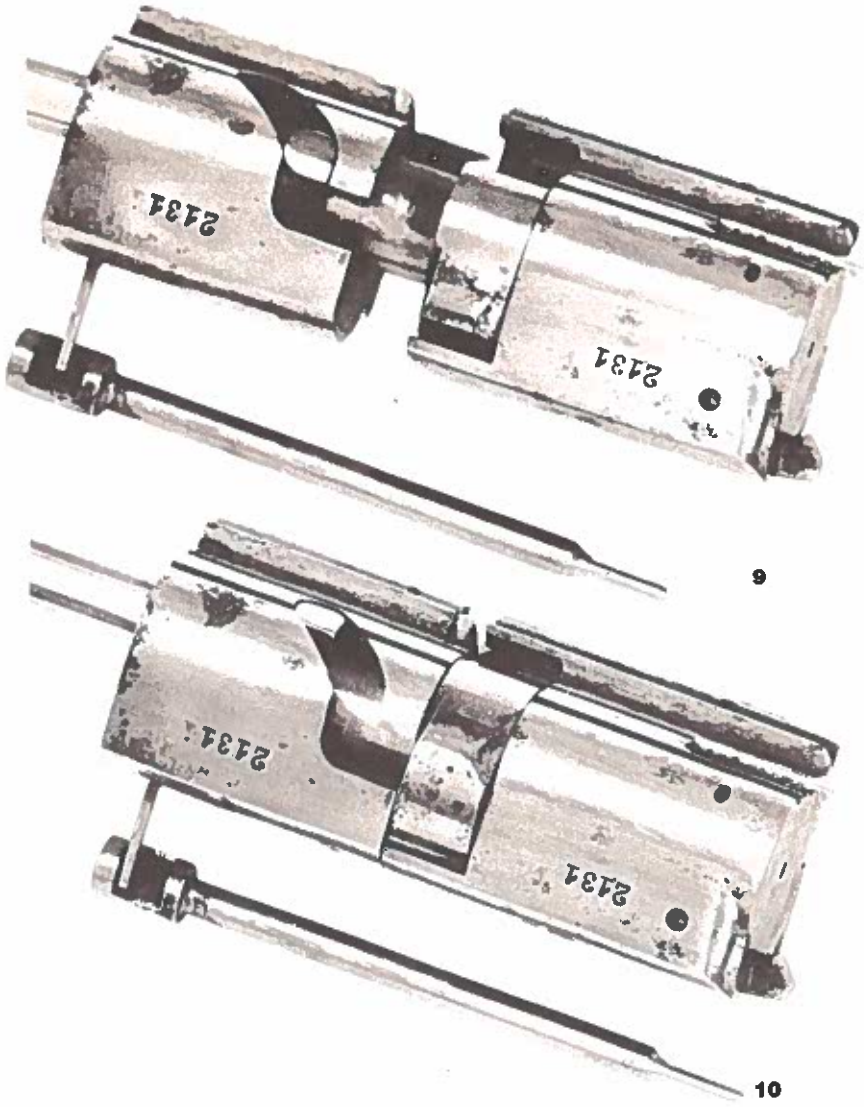
8 *Head and tail in closed position. The protruding round centre bolt normally engages in the recess seen in the barrel extension.*



ulated by a cutout in the barrel extension. In front of this was, I presume, the cut-off. Part 2f was missing, so I machined a new cut-off myself. As seen in Drawing I, the shaft end has been shaped in such a way as to either permit the shell to leave the magazine (Fig. 5) or to depress the shell slightly and prevent it from entering the breech (Fig. 6). The cut-off latch has drilled-out bents to accept the pin and spring housed in the receiver wall (kept in with a grub screw), so as to hold the latch in the up or down position. The cut-off is in action when the latch is in the down position, although the original part may have operated conversely.

The tube magazine holds 4 shells. The parameters of the magazine spring are given in Table 2, whereby hysteresis is great, owing to friction.

Table 3 shows the parameters of the recoil spring. The spring retaining ring (2 e) was missing, and someone,. presumably a village blacksmith, had placed



9 *Striker (normally in the breechblock) cannot protrude through breech-face opening when head and tail sections are extended.*
10 *When head and tail of breechblock come together, the striker is long enough to protrude through breech-face opening.*

a bushing in front of the spring, sawing and rasping out the forearm in the process to make room for the substitute. The spoilt forearm end was then patched up with glue and gummed tape in the bargain! Moreover, the magazine cap (2 c) had been turned down quite a number of millimetres so that a safety margin no longer existed. Thread markings in the woodwork proved that this margin had existed. Without a doubt the gun had been fired more than once in this condition. It would interest me to know how the gun recoiled and functioned in general after this "improvement." Once the striker broke (we must be thankful for small mercies!) this gun was presumably cast off as a museum piece and sold as junk.

As the forearm still retained its original length and shape (apart from the numerous raspings and cracks), I managed to restore it to an acceptable condition by inserting a plastic end-piece and by applying a mixture of casting resin and walnut sawdust. The magazine cap (2 c) was repaired by hard soldering an extension ring to its base. The spring retaining ring (2 e) was machined similar to that of the Browning. I would welcome any photos readers might care to send me of the original magazine cap and spring retaining ring.

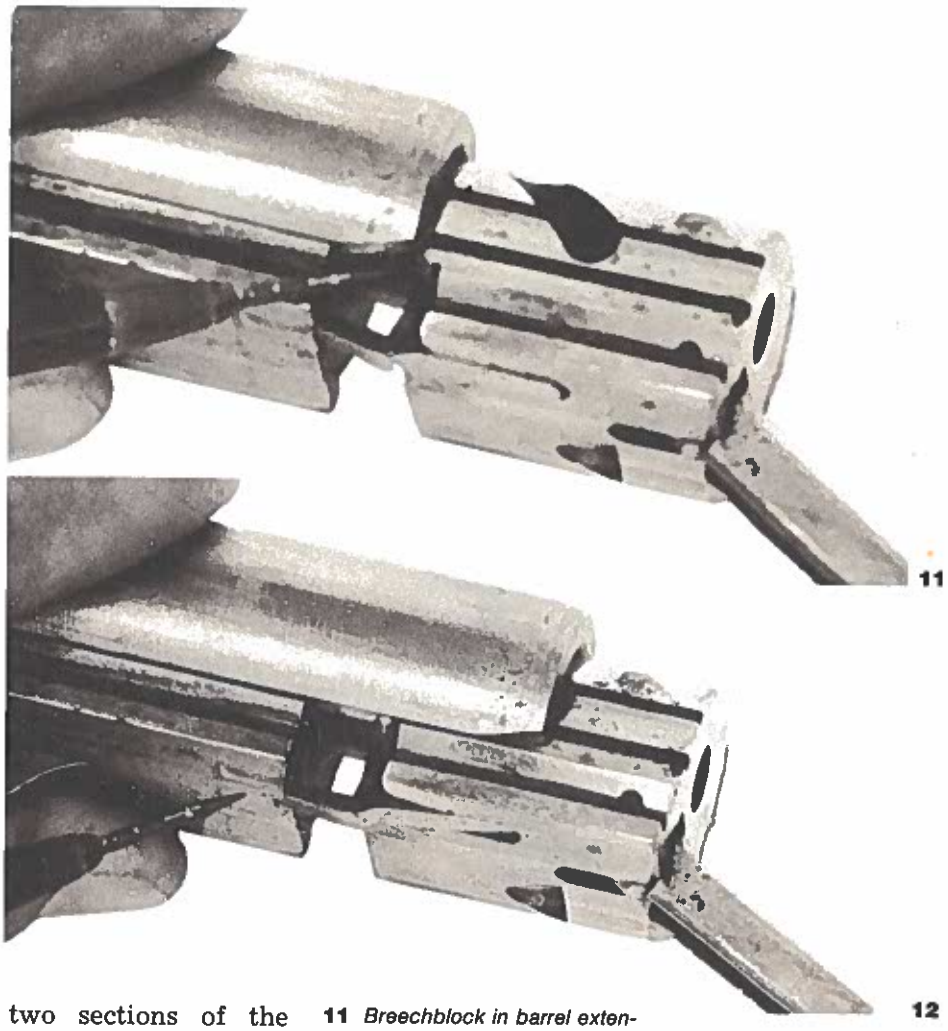
3. The breechblock of the No. 4 is positively locked by a revolving round bolt (3 b), a design differing completely from that of the Browning, which uses the swivelling block. The revolving round bolt has evolved from German machine guns. It is obvious that the firm of Rheinmetall has exploited its military experience in this sector. The round bolt (3 b) is housed in the head of the breechblock and is turned in and out of a recess in the receiver wall by the camway of the separate tail piece of the breechblock, as illustrated in Figs. 7 and 8. The tail piece of the breechblock is tensioned by the action spring (4 l) with cap. The striker is housed in the breechblock and is retained by a limit stop in the tail piece (Figs. 9 and 10). When head and tail pieces of the breechblock are separated, the point of the striker cannot protrude out

of the breech face. Only when the action is locked can the striker reach the primer of the cartridge case. The tip of the striker being broken, I repaired it as shown in Drawing 2. The service life of a striker repaired in this way is, according to my experience, greater than that of a turned striker, since the stresses around the junction point fall away.

Beyond that, drawn spring steel has a pronounced banded structure longitudinally, by means of which its alternating bending strength increases.

The described procedure for repairing broken strikers can be thoroughly recommended for other joins, too. As it was no longer possible to determine the length of the striker's nose, I machined it down to 1.8 mm, suspecting this to be about right.

The breech face has two extractor claws – one on the left, and one on the right (Fig. 9). However, the one is very frail and merely serves as a deputy. A cartridge guide, firm at the rear but tiltable at the front, is mounted on the keel of the head piece (Fig. 13). This one-way gatekeeper guides the shell from the carrier (5 a) in the direction of the chamber and, when the gun is locked, exerts pressure against the remaining shells in the magazine. When loading the magazine anew, this projection is tilted down at the front to clear the passage. The tail piece of the breechblock contains a sprung rocker link, which, when the action opens, jumps between the two sections of the breechblock, acting as a spacer (Fig. 7). When the spacer has engaged, the tail piece of the breechblock cannot exert torque on the round locking bolt. This spacer remains engaged during the entire rearward journey of the breechblock. Only when the breechblock has covered half the distance back to its home position does the spacer disengage, owing to its arm riding up a slope in the barrel extension (Fig. 11). The tail piece, still in motion, begins to impart a rotary movement because of its camway to the round bolt (3 b) in the head section of the breechblock. However, although pressure is being exerted against the round bolt, it cannot turn into the receiver recess until the head piece of the breechblock has reached its forwardmost position (Fig. 12) the striker (3 d) cannot



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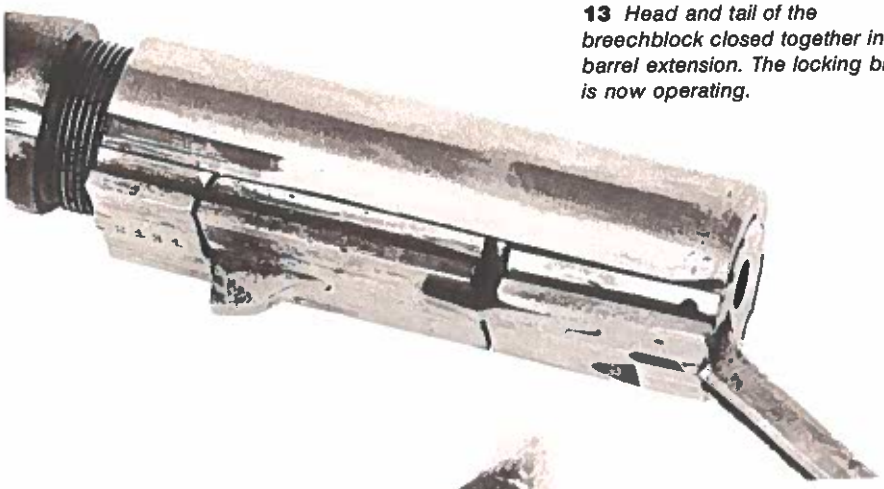
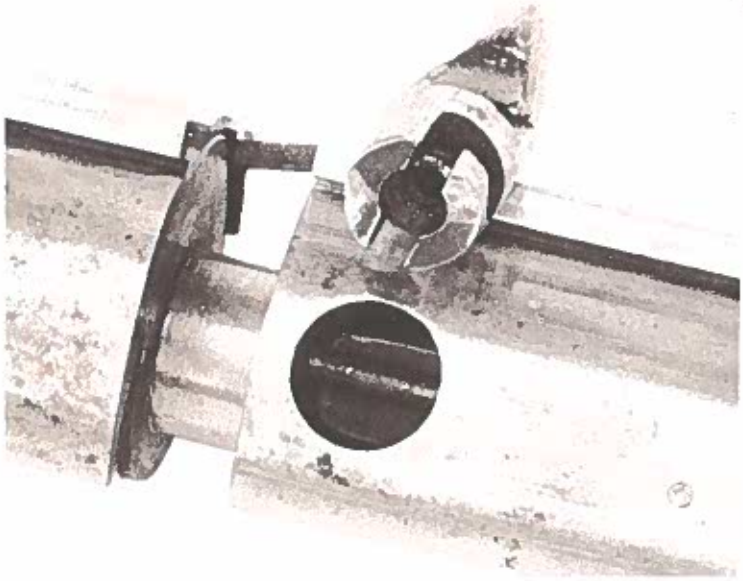
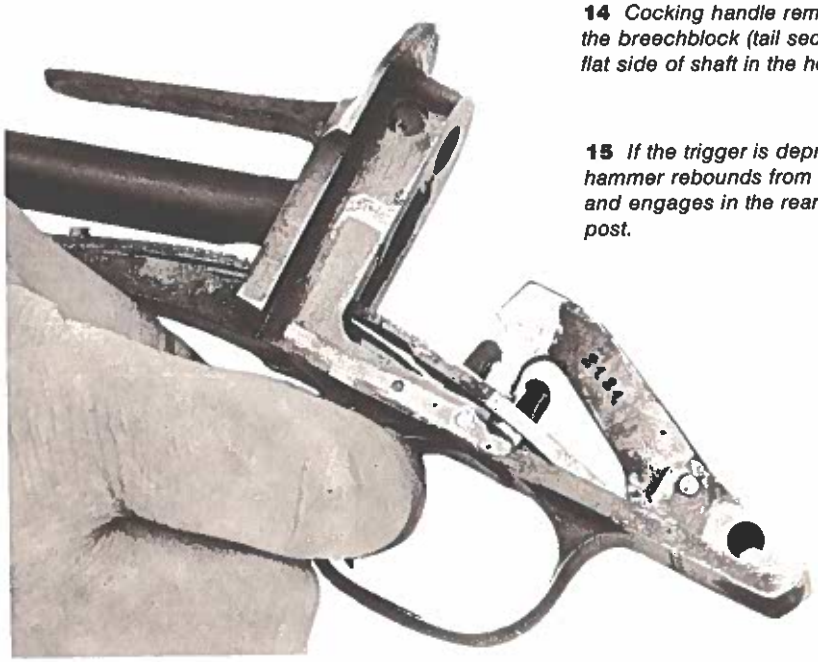
11 *Breechblock in barrel extension. Spacer link has engaged. Spacer arm runs up the slope of the barrel extension.*
12 *Head and tail of the breechblock in the barrel extension. Spacer has disengaged, but the distance between the two breechblock sections remains, since the round locking bolt has not yet been turned into its recess via the camway in the tail section. When the locking block has reached and entered the recess, the tail end of the breechblock can close up behind the head section, but not before.*



13 *Head and tail of the breechblock closed together in the barrel extension. The locking block is now operating.*



14 *Cocking handle removed from the breechblock (tail section). Note flat side of shaft in the hole.*



15 *If the trigger is depressed, the hammer rebounds from the striker and engages in the rear trigger post.*

protrude far enough to ignite the primer until the tail piece has closed up behind its front companion (Fig. 13). The underside of the tail piece sports a notch into which the breechblock stop engages when the last shot has been fired (Figs. 11 to 13). The cocking handle (3 e) is bayonet mounted in the tail piece of the breechblock (Fig. 14). By depressing a spiral spring in the handle, the handle can be turned about 70° and removed from its seating. However, the handle can only be taken down when the two breechblock components are in a certain position, as the shaft (Fig. 14) inside the breechblock that supports the handle is flat at this point only. The cocking handle cannot be removed unless the gun has been stripped.

4. The trigger-plate assembly is also a frame for the stock and a support for the action spring (Fig. 15). Two through-bolts hold it to the receiver. The internal hammer, mounted on a crossbolt at the front end of the trigger plate, has a slotted hole for extra movability. The rear extension of the head is shaped into two offset hooks (B). This extension is obviously a weak point, for the hooks had already been brazed. When the gun is ready to fire, the front lower hook of the hammer extension engages with the front beaked post of the trigger (Fig. 16). When the gun has been fired and the trigger is still in the depressed position (Fig. 15), the rear hook of the hammer extension en-

gages with the rear post of the trigger, after rebounding. The moment the trigger is released, however, the hammer jumps up 2 – 3 mm and engages with the front trigger post, as decribed in Fig. 16 (B).

The safety catch, shaped like a second trigger, is housed behind the trigger proper in the trigger guard (Figs. 16, 17 and 18). The rear section of the guard, where the safety catch passes to and fro within the slot, had to be welded, as this weak spot had been overstrained.

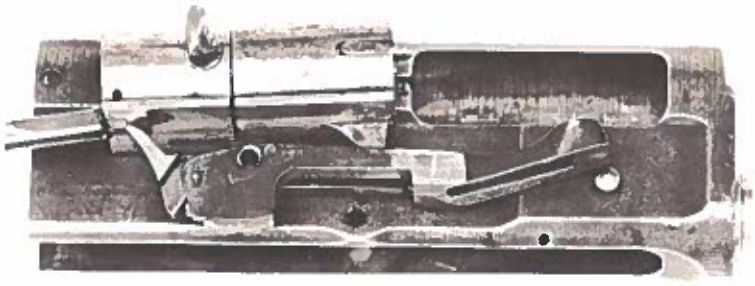
As seen in Fig. 17 when engaged, the shank of the safety catch blocks the rearward movement of the trigger.

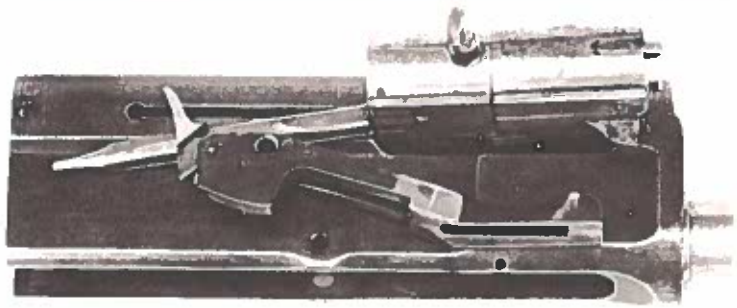
Interesting is the arrangement of the three flat springs for tensioning the hammer, the trigger, and the safety catch. They lie one on top of the other on the trigger plate, and are fastened and pre-tensioned with one screw (Fig. 16), for which the uppermost hammer spring is threaded. The hammer spring is long enough to lie under the knee of the hammer (Fig. 18), and when the weapon is assembled the hammer cannot fly forward further than a vertical position, allowing the spring to remain in engagement under the knee. The spring itself is slotted to permit the trigger posts and hammer double-hook extension to pass through. The other two springs function in normal fashion, whereby the safety-catch spring holds the catch firmly in either "on" or "off" position.

16 *When the trigger is released, the hammer is caught by the front trigger post.*

17 *The (trigger) safety applied.*

18 *The trigger is now free because the shank of the safety has been drawn out of the direct path.*





19 *When the breechblock strikes the carrier dog, the carrier shovel tips upwards.*

20 *When the breechblock returns to its home position, the carrier spring forces the shovel down to line up with the magazine.*

Table I Weights

A) Stationary parts		B) Moving parts	
Stock	315 grams	Breechblock	375 grams
Receiver	693 grams	a) Head	145 grams
Trigger plate		b) Round bolt	67 grams
and hammer	283 grams	c) Tail	144 grams
Action spring		d) Striker	10 grams
and tube	109 grams	e) Handle	9 grams
Magazine and		Recoil spring	
spring	212 grams	and retaining	
Carrier	98 grams	ring	161 grams
Forearm	137 grams	Barrel	757 grams
Fittings	120 grams		
total	1967 grams	total	1293 grams
		Grand total	3.26 kg

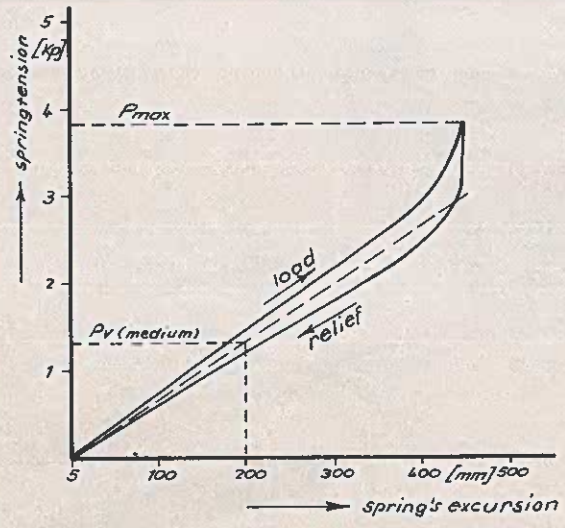


Table 2 Parameter of the magazine spring
Wire Ø = 1 mm, outside twist Ø = 15 mm, length 10 = 510 mm, number of coils = 48

The carrier tube (4 k) for the action spring fits into a cutout in the trigger plate. The collet of the tube prevents the tube from turning (Figs. 15 and 16). This assembly can be taken out from the front side, as clearly seen in Fig. 16. The bottom end of this tube is threaded to accept the stock retaining nut.

The action spring (41) the characteristics of which are shown in Table 4, is fitted with a cap into which the rear rod of the breechblock extends. At its bottom end the spring is supported by a pinned wooden block (4 m) (B).

5. The shell carrier (5 a) is swivel-mounted by screws on both sides of the receiver, and tensioned in the down position by a strong flat spring which is supported by two pins in the housing.

At the rear end of the carrier is the carrier dog which is slightly tiltable. When the front end of the carrier is in the down position, the dog is in the up position, over which the breechblock rides when travelling backward (Fig. 19). This backward movement of the breechblock, by forcing the dog down out of its path, elevates the shovel end of the carrier with the next shell in line with the chamber. When the return-

ing breechblock has chambered the shell, the flat spring presses the shovel down again in line with the magazine (Fig. 20).

6. A guide ring is brazed on the underside of the barrel that encircles the magazine tube. The barrel (6 a) is screwed and locked into the barrel extension (6 b), a part of which forms a two-piece ejector.

7. The forearm (B) has already been dealt with under 2.

Stripping

Pull back on the cocking handle until the breechblock remains open. Press the barrel in slightly and unscrew the magazine cap (2 c). Lift off the forearm (7). The barrel can now be slid off to the front. Assemble the gun in the reverse order, but be careful that the barrel extension presses the shell stop outwards.

To get to the mechanical parts, undo the two screws of the trigger plate (4 a) and draw stock and trigger assembly out to the rear. The breechblock can be removed by deactivating the locking mechanism and pushing the cocking handle forward into the ejection port. Now depress the cocking handle, twisting it a quarter of a turn to the left, and lift it from its recess (beware of the spring in the handle!). The breechblock can now be slid out to the rear. By slightly turning the breechblock its parts can be separated from each other.

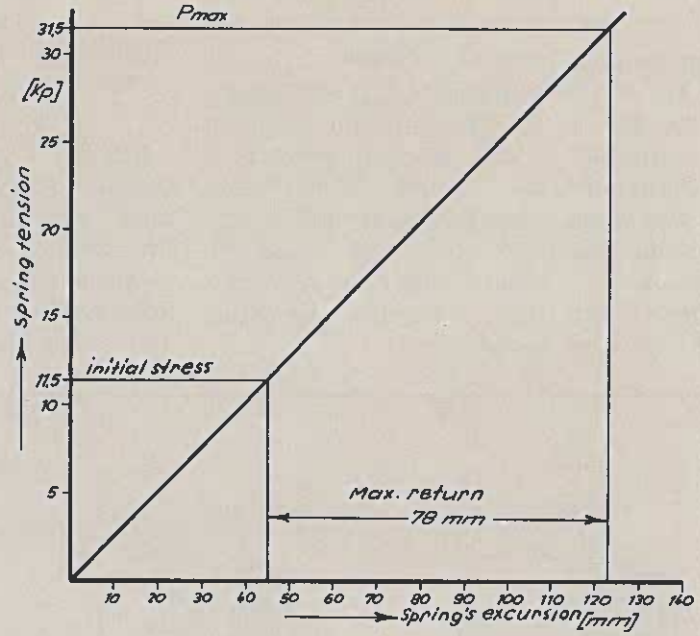


Table 3 Parameter of the recoil spring
Wire ϕ=3mm, outside twist ϕ=29,4 mm, length 10-248 mm, number of coils=18 plus a dead half turn at each end

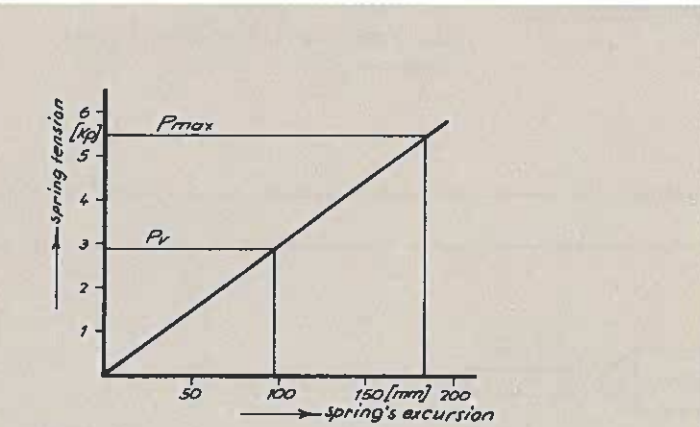


Table 4 Parameter of the action spring
Wire ϕ=11mm, outside twist ϕ=70,5 mm, length 10-323 mm, number of coils=64

As mentioned before, a special socket wrench is needed to take down the stock. But since there is hardly an occasion when stock stripping is necessary, this does not matter very much.

To dismount the carrier all one needs to do is to remove the two side screws in the receiver.

In order to re-assemble just reverse the procedure. Stripping the Rheinmetall No. 4 is a much simpler proposition than stripping the FN Browning automatic shotgun.

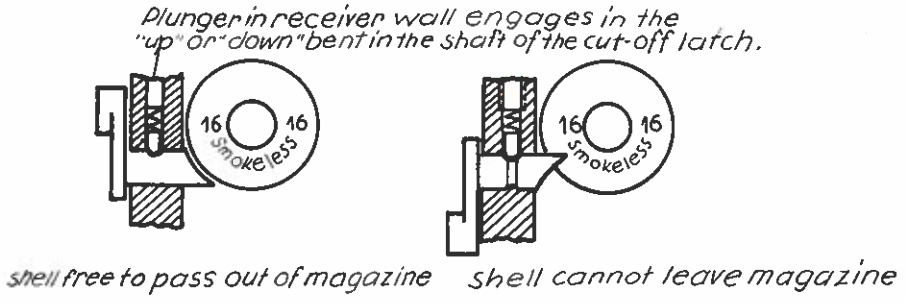
Shooting

The gun was put through its paces with 10 16/65 Habicht shells. The No. 4 did not jam once, even when firing off in very rapid succession. Ejection was wonderfully consistent, and the hulls were thrown about 2 1/2 m. The primers being deeply indented, showed that the striker projection was still too long. This was easy to decrease.

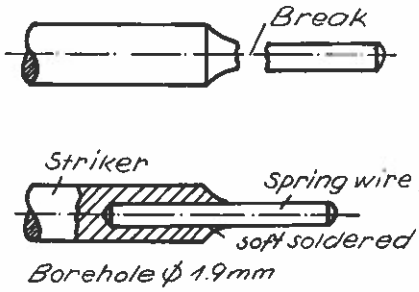
Recoil is soft and pleasant. The retaining ring (2 e) is thus working properly, I can assume. When firing more powerful shells a second cone nut could be placed under the retaining ring to increase the recoil brake effect.

Despite the short stock the gun shoulders quite nicely, and is a natural pointer.

Finally, I would like to say how sorry I am that I must return this gun to Rheinmetall. It isn't by any means a museum piece, believe me it's a very efficient and usable gun.



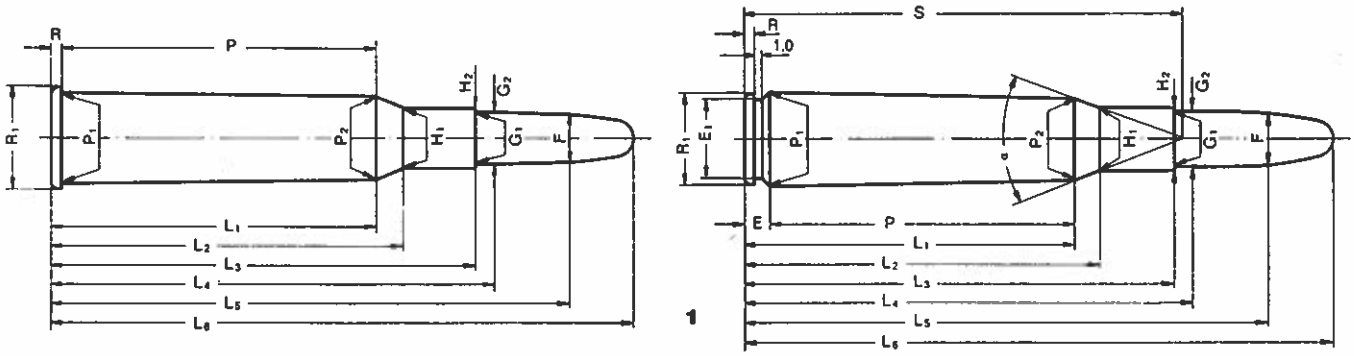
Drawing 1: cut-off (2f)
How the cut-off latch works
Scale - 1:1



Drawing 2: Repairing the striker (3d)
Even off the surface of the break, and bore a hole down the centre of the striker stump. Seat spring wire firmly into hole and soft solder. Point should be ground to a length between 1.6 - 1.9 mm.

Text and drawings by Alfred Müller

Granddad's Rifle is not dead



1

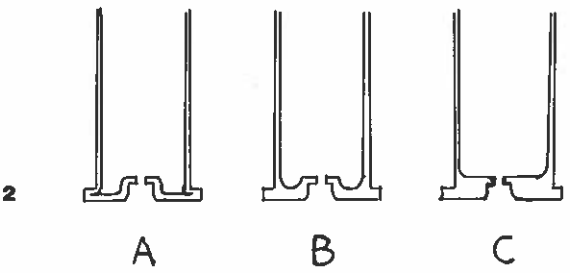
Fig. 1 *Measuring a cartridge. For reshaping P1, R1, R and L3 are most important. The others need only be known to cartridge and die manufacturers. If you do not want to make the reshaping dies yourself, LYMAN, RCBS, Redding, etc. have them in almost all calibres. They will even make them to special order.*

The number of excellent rifles stowed away in gun cabinets by collecters is legendary. The lack of modern ammunition has usually "muzzled" them, since insufficient demand, especially for the old black-powder cartridges, has put a stop to production. Regrettably, even the days of the once-popular 9.3x72 R are numbered. Even if the ballistic performance of this cartridge cannot keep step with that of modern versions, it is still a special kind of pleasure and fascination to fire a gun that was probably used by Granddad with great enthusiasm.

It's true that specialist antique dealers offer old cartridges in one form or another, but in most cases the price paid today by collectors for these old loads is so iniquitous that it would be a shame to fire them, and old cartridges are usually unreliable anyway. Owners of an M 71 or 71/84, on the other hand, can now be cheerful, for the Canadian firm of DOMINION has re-introduced them. Still, owners of other oldies need not go into mourning. The title of this article indicates in itself that these old trusties are only seemingly dead, with the exception of a few. For modern cartridge cases can be re-sized to old calibres with little ado, providing the gun buff has the basic re-loading equipment to do the job. However, at this point I must emphasize that I am only speaking about centre-fire, not rim-fire cases, since the latter are far too difficult and dangerous for the average re-loader to tackle properly.

Reasonable results can be achieved, although the going will be slow, with only a vice, hand reshaping die, and a file. However, to be able to get things done better and quicker, I suggest you stock yourself with the following items:

- Reloading press
- Various resizing dies
- Case trimmer
- Deburring tool
- Resizing lubricant
- and in some cases a lathe.



2

Fig. 2 *Old and modern cartridge designs. A has a folded base, B a so-called balloon base, and C a modern solid base. Only the last type can be repeatedly reused, and are more durable than the originals.*

With the exception of the light loading presses and cavity moulds, such as the LYMAN TONG TOOL 310, all commercial presses fit the bill admirably. The difference between success and failure in resizing largely depends on the correct choice of brass*) at the outset. Fig. 1 shows the measurements that have to be considered by the cartridge designer. Fortunately, for us reloaders the situation is a lot simpler; as only P1, R1, L3, and to a certain extent R, are important. Between the old case and the resized case differences in P1 should be as little as possible. It is feasible to resize P1 by 1/10 mm, either by reshaping in the gun, pressing, or occasionally turning; but remember that the base of a cartridge case is the part that receives the full force of the explosion, hence it should never be weakened. Between your face and those white-hot powder gases are only a couple of millimetres of brass!

The general condition of the case is not unimportant either. Who wants to take the trouble to resize the critter when it is obvious that it will not withstand more than a couple of reloads and will soon be breathing its last?

Check the mouth, neck and base of your empty cases for weak spots. It is not worth your while to work on cases already showing cracks. You must have a good idea of the amount of pressure a given case will withstand, and the type of load suitable, etc. Furthermore, a corrosive primer can already have affected the whole case. Dubious pieces should always be relegated to the dustbin.

It is also worth your time to collect brass (cases) that will accept the Boxer primer, for these are simpler to reload than the Berdan type. The normal procedure is to use rimless cases for making other rimless cases, and rimmed cases for making rimmed cases, but there are exceptions. It is possible to change a rimmed case into a rimless case by turning down the rim in a lathe. The cannelure for the extractor can be machined in, too. To make a rimmed case from rimless brass, P1 has to be turned down until the cannelure is flat. Such operations, however, are only practicable with modern cases; older brass is too weak at this critical point, as can be seen in Fig. 2.

If you have the tools and sufficient brass at hand, we can now start by describing each step in turn. Of course, not every operation listed here is always necessary, but sometimes even greater skills are required. I am now speaking of a few exceptions where the average loader had best steer clear or make a compromise. Making a perfect 9.3 x 82 R from a 9.3 x 72 R is one of these instances.

*)cartridge case to be converted

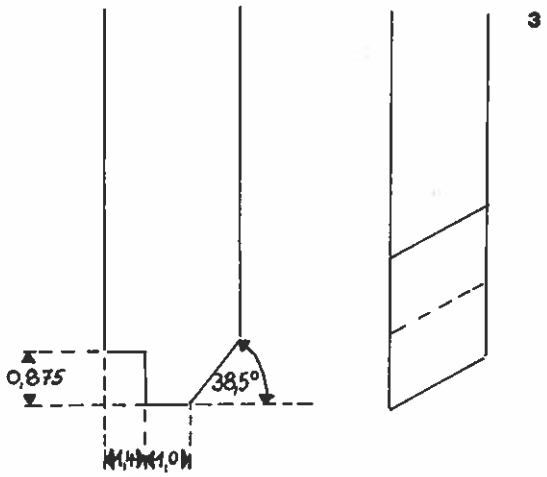


Fig. 3 *Cutting tool – not to scale – for turning down R1 and R, and for producing or deepening the cannelure. It cuts the cannelure for the 8 x 57 IS, but can be used for other cartridges, too, since the extractor has sufficient space to engage.*

Resizing

This is nothing new to reloaders, but a few words should be spoken on the subject, as resizing and reshaping requires more precision than plain reloading.

Brass must be properly lubed before placing it in the die, otherwise it gets stuck and is nigh impossible to get out again. A drop of the special oil makes all the difference between success and failure. If too much lubrication is employed dents will occur in your cases, for oil cannot be compressed. The usability of the cartridges is seldom undermined by these dents, still, they look very ugly. It can happen, though, that too much oil causes the neck to cave in, and that means yet another case for the dustbin. Light household oil is **not** suitable, as it does not form a strong enough film. I would recommend only the commercial resizing lubricants, such as those marketed by LYMAN, PACIFIC, RCBS, etc.

Adjust the resizing die according to the instructions enclosed, and lift the shell holder far enough to make contact with the bottom surface of the die. Sometimes one or more intermediate dies are required, e. g. when a 6.5 X 40 R is to be formed from a 9.3 x 72 R. By using one die only the mouth of the case would cave in. I recommend that you reduce the mouth to about 7.8 mm to begin with. The die used for reloading will do the rest at the second pass, so to speak.

Naturally, the whole length of the case is resized in this instance, not just the neck!

Old calibres required				Brass used				Reshaping techniques
Continental	P1	R1	L3		P1	R1	L3	
5.2x34 R Kronprinz	7.85	8.94	33.5	5.6x35 R Vierling	7.55	8.85	35.5	KVL, T, FF
5.6x33 Rook	8.35	8.35	33.7	.218 Bee	8.76	10.29	33.88	RA, PP, ARD, KVL, T
5.6x33 R Rook	8.55	9.55	33.7	.218 Bee	8.76	10.29	33.88	PP, RA, to 9.55, KVL, T
6.5x40 R	10.85	12.6	39.95	9.3x72 R	10.85	12.2	71.9	KVL, T, HA (see footnote 1)
6.5x41 R	8.05	10.29	41.48	7.62 Nagant	9.0	9.7	38.5	PP, KVL, GHS
65x50 Japan. Arisaka	11.46	12.04	50.8	.220 Swift	11.28	12.01	56.03	KVL, T, FF
6.5x51 Carcano	11.38	11.41	51.05	6.5x54 Mauser	11.4	11.4	53.66	KVL, T
6.5x53 R Rum & Holl.	11.4	13.38	53.6	.303 British	11.48	13.41	56.11	KVL, T
6.5x58 R	10.89	12.65	58.22	9.3x72 R	10.85	12.2	71.9	KVL, T, HA
6.6x48 R	11.0	12.68	48.0	9.3x72 R	10.85	12.2	71.9	KVL, T, HA
7.35x51 Terni	11.33	11.41	51.05	6.5x54 Mauser	11.4	11.4	53.66	HW, KVL, T
7x22 R	10.82	12.2	71.76	9.3x72 R	10.85	12.2	71.9	KVL
7.5x55 Schweiz. Ord.	12.6	12.6	55.4	10.7x68	12.65	12.65	67.92	KVL, T, HA, FF
7.5x54 MAS	12.2	12.2	53.5	5.6x61 v. H. SE	12.09	12.09	60.9	KVL, HW, T, FF
7.62x63 Sjorgen	12.09	12.17	61.8	5.6x61 v. H. SE	12.09	12.09	60.9	FF, GHS
7.92x33	11.88	11.88	32.8	8x57 JS	11.88	13.2	56.7	KVL, T
8x37 R Tesching	8.54	10.0	36.9	.218 Bee	8.76	10.29	33.88	PP, FF, GHS
8x42 R	11.9	13.3	41.80	8x57 JR	11.88	13.2	56.7	KVL, T, FF
8x48 R	10.9	12.65	48.0	9.3x72 R	10.85	12.2	71.9	KVL, T, FF
8x51 Mauser kurz	11.94	11.94	50.82	8x57 J	11.88	11.88	56.7	KVL, T
8x51 R Mauser kurz	11.94	13.3	50.82	8x57 JR	11.88	13.2	56.7	KVL, T
8x51 R Lebel	13.74	15.9	50.24	.384 Win.	13.87	15.37	57.1	KVL, T, FF
8x58 R Krag.-Jörg.	12.78	14.66	57.84	.45–70	12.7	15.2	53.34	KVL, RA to 14.66, GHS, FF
8x72 R	10.8	12.2	71.9	9.3x72 R	10.85	12.2	71.9	KVL
8.15x46 R Normalis.	10.68	12.24	46.34	9.3x72 R	10.85	12.2	71.9	KVL, T, FF
9x58 R	10.89	12.65	58.22	9.3x72 R	10.85	12.2	71.9	KVL, T
9.1x40 R	10.2	11.55	40.0	5,6x52 R	10.5	12.34	51.7	RA to 11.55, PP, KVL, HW, T, FF
9.5x47 R	13.05	15.0	47.0	11.15x60 R M 71	13.1	14.92	59.80	KVL, T, FF
10.4x38 R Martini-Gallard	13.76	15.78	38.2	.348 Win.	13.87	15.37	57.1	HW, KVL, T
11.52 R Dän. Rem.	13.0	14.78	51.18	.45–70	12.7	15.2	53.34	KVL, T
11x59 Gras	13.78	16.76	59.44	.348 Win.	13.87	15.37	57.1	HW, KVL, FF, GHS
11.15x52 R Sauer Expr.	11.88	13.2	51.7	8x57 JR	11.88	13.2	56.7	HW, KVL, T
11.2x38 R Grenzaufseher	13.10	15.0	37.6	11.15x60 R M 71	13.1	14.92	59.8	KVL, T, FF (see footnote 2)
11.2 Span. Rem.	13.16	16.0	57.15	.348 Win.	13.85	15.37	57.1	PP, HW, KVL, GHS
11.5x36 R Kropatschek	12.56	14.52	35.7	8x50 R	12.5	14.02	50.34	HW, KVL, T, FF
American								
6 mm Lee Navy	11.25	11.18	59.9	.220 Swift	11.28	12.01	56.03	RA, ARD, HW, KVL, GHS
.25 Rem.	10.59	10.64	52.07	.30 Rem.	10.62	10.59	52.07	KVL
.30 Newton	13.36	13.21	63.41	.300 Win. Mag.	13.48	12.98	72.39	(see footnote 3)
.30–30 Wesson	9.65	11.23	42.16	.256 Win. Mag.	9.6	11.2	40.39	FF, GHS
.32 Ideal	8.89	10.26	44.45	7.62 Nagant	9.0	9.7	38.5	FF, GHS
.32–40 Bullard	11.43	12.9	46.74	.303 Brit.	11.48	13.41	56.11	HW, KVL, T, perhaps RA to 12.9
.33 Win.	12.83	15.44	53.47	.45–70	12.7	15.2	53.34	KVL, GHS
.38–40 Rem.-Hepburn	11.53	13.64	45.0	.303 Brit.	11.48	13.41	56.11	KVL, T, HW
.38–70 Win.	12.73	15.2	53.4	.45–70	12.7	15.2	53.34	KVL
.40–50 Shps. Str.	11.46	14.0	47.12	.303 Brit.	11.48	13.41	56.11	HW, KVL, T
.40–85 Ballard	12.18	14.12	74.42	9.3x74 R	11.8	13.2	74.5	HW, T, FF
.40–90 Shps. Str.	12.12	13.72	82.55	9.3x74 R	11.8	13.2	74.5	HW, GHS, FF
.45–100 Ballard	12.65	12.37	71.4	.300 Wea. Mag.	13.48	13.44	71.74	GA, RA to 12.37; PP, ARD, HW, KVL, FF
.50–70 Gov't	14.3	16.76	44.45	.348 Win.	13.87	15.37	57.1	HW, T, FF
.50–100 Win.	14.02	15.29	61.14	.348 Win.	13.87	15.37	57.1	FF, GHS
.50–115 Bullard	14.35	15.49	57.15	.348 Win.	13.87	15.37	57.1	FF
British								
.310 Cadet	8.89	10.26	28.24	.32–20 Win.	8.97	10.36	33.4	KVL, T
.333 Flanged NE	13.72	15.62	62.23	.348 Win.	13.87	15.37	57.1	KVL, GHS
.333 R-less NE	13.72	13.77	62.23	.348 Win.	13.87	15.37	57.1	RA to 13.77; ARD, KVL
.350–7 mm Rigby	11.94	13.41	63.25	9.3x74 R	11.8	13.2	74.5	KVL, T
.416 Rigby	14.96	14.96	73.66	.378 Wea. Mag.	14.83	15.39	74.17	GA to 14.96; KVL, ARD, HW
.450–400–2 3/8 BRE	13.89	15.62	60.33	.348 Win.	13.87	15.37	57.1	FF, GHS
.360 No. 3 BPE	10.92	12.76	48.51	9.3x72 R	10.85	12.2	71.9	KVL, T
.450 No. 1 Carbine	14.63	16.76	39.98	.500–3" NE	14.5	16.28	76.2	KVL, T, FF
.450 No. 2 Musket	14.63	16.76	59.94	.500–3" NE	14.5	16.28	76.2	KVL, T, FF
.577–450 Martini	16.89	18.77	59.08	.577–3" NE	16.92	18.77	76.2	KVL, T, FF
.577 Snider	16.89	18.77	50.8	.577–3" NE	16.92	18.77	76.2	KVL, T

Footnotes

1) Brass, relatively speaking, is a brittle material. If it is to withstand reshaping, and later reloading, the case must be softened at critical points. The case, without primer, is stood up in a metal pot with about 1.5 cm of water. After quickly heating the neck with a blow torch until it glows, knock the case over into the water.

2) As said in the text, a Mauser-type base is not necessary when using black powder. If you want to use smokeless powder for a cartridge like the 8 x 60 R Guedes, I recommend for reasons of safety that you construct a Mauser base. As near as possible the required rim is turned on the lathe, a brass disc of the right thickness is then soldered in place.

3) Most big-calibre Newton-type chambers will accept the belted .300 Win. Mag., without changes to the case. If your rifle is stubborn on this point, turn or file down the belt until it fits the chamber, continue with KVL, T, and FF.

Abbreviations

BPE	Black Powder Express
Gov't	Government
Holl.	Dutch
Mag.	Magnum
MAS	Manufacture d'Armes St. Etienne
NE	Nitro Express
Rem.	Remington
R'less	Rimless
Rum.	Rumanian
Shps. Str.	Sharps Straight
v. H. S. E.	vom Hofe Super Express
Wea.	Weatherby
Win.	Winchester
ARD	turn to deepen cannalure
FF	reshape in gun (fire form)
GA	remove belt
GHS	seat bullet higher
HA	ream neck
HW	bell mouth
KVL	resize full length
PP	resize P1 by pressing
RA	turn off rim
T	trim

Trimming

One can only get around this task when the case is too short, or just the right length. In reality, quite a lot of material usually has to be removed, either by filing or by using one of the commercial trimmers. Both methods cost time. I would propose, with long brass, such as the 9.3 x 72 R, that a metal saw is used to get down to the approximate size required, or the WILSON machine that will cut off any width of neck you like at one turn of the handle.

Trimming is subsequent to all other resizing operations, for trimming tends to pull the mouth down unevenly. Take away a couple of 1/100th mm more; you won't then have to re-trim when the neck has stretched itself after a few shots.

Belling, or neck expansion

This has to be done when the neck of the brass you are using has a smaller diameter than the required calibre. If the difference in neck calibre is only slight between the two, such as between the 7.35 x 51 Terni and the 6.5 x 54 Mauser, belling can be accomplished in the resizing die by using an expander plug. Remember to remove the decapping unit when working on Berdan cases!

Some expander plugs have sharp shoulders that shear off surfaces or even press in the case necks when extra pressure is used. You can safeguard yourself against this happening by grinding it to a cone, and then polishing. With a conical neck expander it is possible to bell the mouth by 1.5 mm at one pass. However, if you are not sure how far you can go at one pass before damaging or splitting the neck, bell in stages of 0.7 mm. How far one can expand a neck at one go depends chiefly on the alloying constituents. This, of course, no one can know in advance, so it is wiser to be cautious.

If extensive belling is on your programme, i. e. reshaping 5.6x52 Rs into 9.1x40 Rs, it is better to apply the step by step procedure, to save brass. How to get all those expander plugs? Well, if you are fortunate enough to possess a number of dies for various calibres, the going is simple; for each of these expanders will assist you on your way.

Otherwise you can make your own expander plugs or purchase an expanding die from RCBS, which fits into the press and works with any number of expanders. The die is universal.

Reshaping in the gun (fire forming)

Sometimes a case is too skinny or the height of the shoulder is too low. In such instances one can only achieve the right dimensions by loading the case and firing it in the gun it is intended for. Usually, only a very light load is employed, but occasionally a full load is required. A good example here is the 8.15 x 46 R when reshaped from the .30 – 30 Winchester. However, reshaping or "fire forming" in the gun with a full load should be limited as far as possible. Those of my readers who have little inclination to wander down to the shooting range to reshape their brass, had better go down into the cellar. A little fast-burning powder, e. g. Bullseye from HERCULES, is poured into the case and the rest of the cavity is filled with flour. Seal the mouth with hard soap, wax or toilet paper. At this point a word of warning: even with this weak load gas pressures can prove dangerous. My advice here is to start with about 10 per cent of the case volume, and then to work up to higher loads.

Reshaping in the gun is occasionally a substitute for belling, especially when the brass has the right length. A .348 Win. can be perfectly reshaped in the gun chamber to a .50 – 100 Win. This method has the advantage that the shoulder assumes the new angles, which is not always achieved with dies. Furthermore, by reshaping in the gun chamber P1 can be extended by 0.4 mm (max.).

Lathe work

Turning off is necessary when R1 or R have oversized dimensions. Remember to remove the superfluous material from the inside, not from the base side, otherwise the wall of the primer cavity will stand proud, and if this wall is turned off, too, the cavity or pocket will be too shallow to accept the primer. In some instances the primer cavity can be deepened, but as said before, weakening any part of the base is a highly dangerous proposition.

A cutting tool illustrated in Fig. 3 is so designed as to work R1 and R at the same time, if required. This tool is also ideal for deepening the cannelure, or for cutting a new one, which would be necessary if P1 were reduced. This tool cuts a cannelure similar to that of the 8 x 57 IS, but can be used on other cases as well.

If P1 is a little too thick, the case can be turned down at that point. But, as mentioned before, only modern cartridges will survive such an operation. As seen in Fig. 2 and 3 older cases are too flimsy at this

section. My advice is to cut a couple of cases in half that have been turned down, to see whether the wall is still thick enough. More than 0.2 mm should not be removed from P1. If this does not suffice for your requirements, you had best refer to the next procedure.

Base forming

By using special dies, P1 can be reduced by 1 to 1.1 mm. But so much pressure is needed to reform a cartridge case that a heavy duty press, if possible with compound leverage, is a must for acceptable results. One can, of course, use a powerful vice, since most of us do not possess a hydraulic press.

The die required is very simple, not even a thread is needed. The die consists of a piece of strong tubing of the correct diameter (Fig. 4), i.e. at least the first 8–9 mm. However, over this length the die must be hardened and polished. Above this section (A) the diameter can be larger, allowing rimless cases to be pushed all the way through.

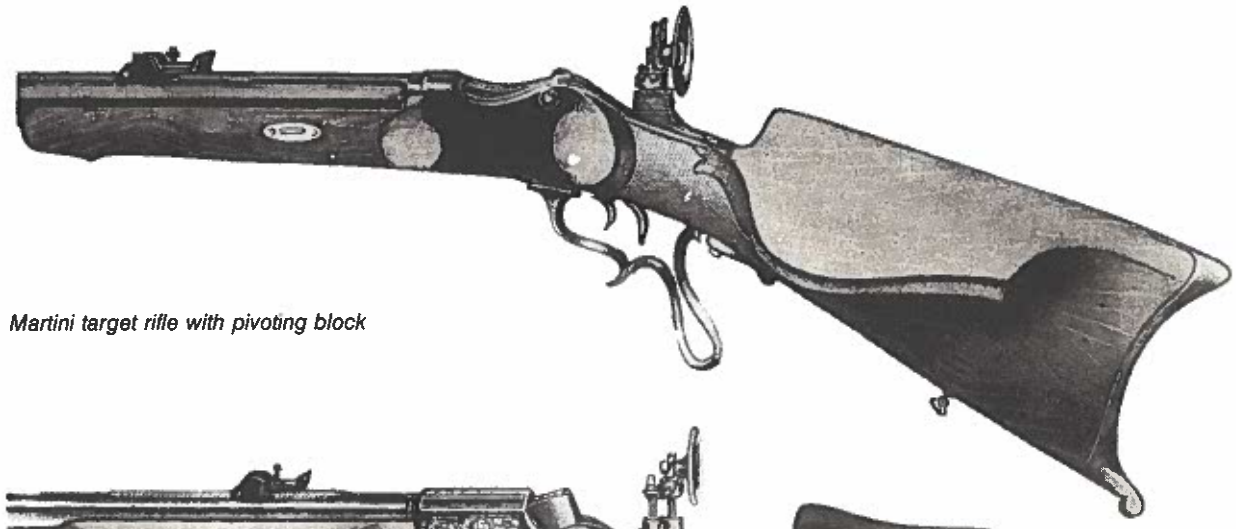
If you use the die in a loading press a thread and locking ring will, of course, be necessary. Furthermore, the case holder must be filed down as shown in Fig. 5. The rim cannot withstand the pressure applied to remove it from the die. The case is pressed out with a rod from the top end, being careful not to damage the primer cavity. Even pressure is best.

If your press is not very powerful, reforming can only be accomplished in stages, about 0.15 mm at a time. However, if you are working with a hydraulic press or a powerful vice, reducing can be done at one pass.

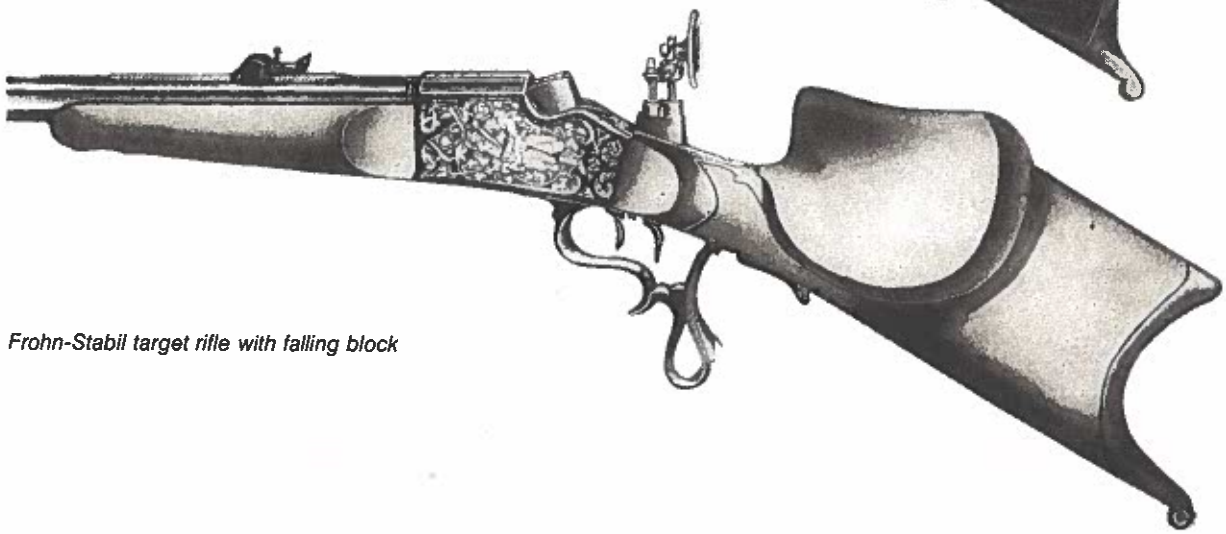
Should you not be in the position to make your own dies, you can fall back on the commercial versions. RCBS offers a set of base forming dies for about $ 20.

Reaming outside neck

When short-necked cases are made from long-necked brass, the outside diameter of the neck is too thick (G1 in Fig. 2). If one reshapes, for example, a 6.5 x 40 R from a 9.3 x 72 R, the reshaping operation in itself will cause the neck to become thicker than required, apart from the fact that the larger case is made of thicker material 3 cm from the mouth. Reaming is the only solution. Outside neck turning accessories are available that can be attached to



Martini target rifle with pivoting block



Frohn-Stabil target rifle with falling block

commercial trimmers. Inside neck reamers are also on the market.

Now a few examples of how to reincarnate cartridges for granddad's rifle. Let us assume you possess a target rifle chambered for the 9.5 x 47 R. This cartridge has a so-called Mauser base. The only modern cartridge around today with this sort of base is the old M 71/84, which, fortunately, has a P1 of 13.1 mm, in contrast with 13.05 mm of the 9.5x47 R. Resize the M71 full length in the 9.5x47 R die, whereby decapper and expander plug might have to be removed to provide room for the longer brass. The neck has only to be trimmed down to about 46.8 mm, and the case is ready!

A little more complicated is the making of a 9.1 x 40 R from a 5.6 x 52 R. P1 of the brass is 0.3 mm too thick and has to be reduced. R1 is also 0.8 mm too large.

Regulate P1 by passing it through the press, turn the rim down, size the case full length, trim to about 39.8 mm and give a final reshaping in the gun by fire forming.

If you have a rifle chambered for the 5.6 x 33 Rook, you can use the .218 Bee brass, although it has a rim and too thick a waist. Turn down the rim completely, reduce P1 to 8.35 mm, and cut new cannelure. Finally, trim the case to 33.6 mm, and reshape with a reduced load in the gun.

Of course, some of my readers will ask, quite rightly, how to obtain a Mauser base when the brass has a normal rim. Well, if it's a black powder cartridge you are thinking of, the Mauser base will not have to be recreated.

It will suffice when the brass is reshaped in the gun, so that the rim lies snugly against the bolt face. In most instances a little bit of the case is exposed, but this is nothing to worry about with low pressure black powder. By employing this method, the .348 Win. can be turned into an 11 x 59 R Gras.

Before drawing this article to a close I should like to emphasize that a number of different types of brass are available for turning into obsolete cartridges. The table lists brass that is easy to come by. For example, you can make the 6.5 x 51 Carcano from the 7.35 x 51 Terni, just by resizing. However, in the list, I have given the 6.5 x 54 Mauser preference, since it is easier to get.

Anyone who follows my examples and reads the table will realize that a little imagination, work and skill will bring his granddad's shooting iron back to life again. That old gun that has been hanging on the wall for so long will be spitting fire, smoke and lead again, if you want it to.

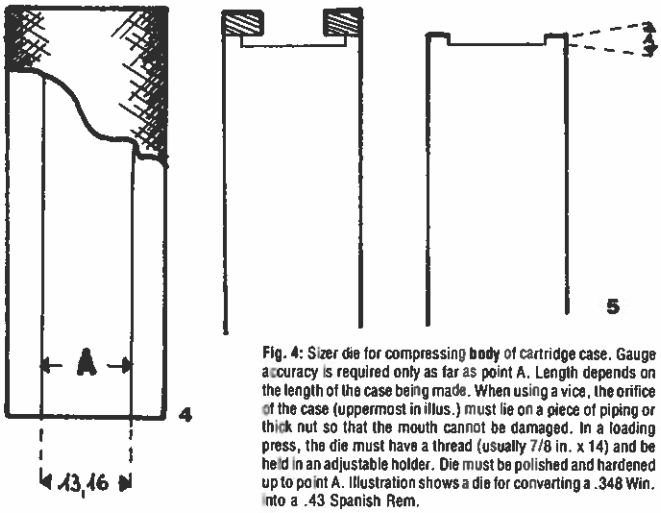


Fig. 4: Sizer die for compressing body of cartridge case. Gauge accuracy is required only as far as point A. Length depends on the length of the case being made. When using a vice, the orifice of the case (uppermost in illus.) must lie on a piece of piping or thick nut so that the mouth cannot be damaged. In a loading press, the die must have a thread (usually 7/8 in. x 14) and be held in an adjustable holder. Die must be polished and hardened up to point A. Illustration shows a die for converting a .348 Win. into a .43 Spanish Rem.

Fig. 5: Case shell holder used in conjunction with the loading press for reducing the diameter of the case head. The hatched section of a normal holder (left) is filed down far enough till the remaining wall just encompasses the cartridge case head. A, corresponding to the thickness of this head.

Comments re the table

The expression "seat bullet higher" often appears in the table. When using short brass with the bullet seated normally, the bullet would be too far from the rifling. Only experimentation can tell us how deeply the bullet should be seated. There are no cut and dried rules, but it is generally accepted that the bullet should not quite touch the grooves of the barrel.

You will be wondering why bullet diameters have been left out. Since the bore of old guns is subject to inconsistency, I felt it wiser not to include definite figures.

To obtain the correct calibre of your rifle you can push a slightly oversized soft lead bullet through the entire length of the barrel. Measure from land to land with calipers or a micrometer.

Furthermore, I cannot guarantee that my measurements for old cartridges are always accurate. In grandfather's days, tolerances in machining were greater than they are today. The figures I include are based on my own measurements or taken from specialist literature. Very rarely can one measure a number of samples of a given calibre, so it is possible, though improbable, that a cartridge listed in the table will not fit the gun. In case of doubt, therefore, I recommend that you cast a mould of the gun's chamber. If you then deduct 0.1 to 0.15 mm from the diameter of the mould, you will have the exact calibre.

The case holder must be modified by filing off the hatched section. The rim cannot withstand the pressure required to remove it from the die. The case must be pressed out with a rod from the top end.

GERHARD SEIFERT

Hans-Joachim von Zieten, famous cavalry general under Frederick II (The Great), 1699 – 1786.
Illustration of Gen. Zieten by courtesy of Hansa-Verlag, Hamburg, from the book "Friedrich der Große und seine Zeit."

Drawings: G. Seifert
Photos: W. Weller

The Old Prussian Hussar Sabre

Although specialist literature is crowded with details about Prussian edged weapons, very little can be found on the Prussian Hussar sabre of the 18th century. Most of these articles are contradictory, and superficial in the bargain. This state of affairs can probably be attributed to the fact that these sabres were already rare when books on weapons, as we know them today, put in an appearance. Attempting to recover lost ground can hardly lead to success; for the Old Prussian Hussar Sabres are nowadays rarer than ever before. Hence, the author had no other choice but to draw upon his own articles in books and essays and to add a few new observations.

PRUSSIAN HUSSARS

The appellation, "Prussian Hussar Sabre M 1721," also used by authors of high renown, should be dropped. I make this claim since Prussia formed the Hussars in 1721 by recruiting Polish Wallachians, a unit consisting of only 30 men, according to the editor of "Das Sponton," too small a group to have a sabre model of their own.

At this point I would like to cite Dreiss, who wrote: "Friedrich Wilhelm I inducted the Hussars into the army in 1721. Their uniforms and arms were copies of those of other states, especially of Austria. The original sabres issued corresponded to the Austrian type. Later on, 3 models were authenticated that followed in quick succession; models that differed in length of blade and had minor differences in hilt and scabbard." So you see, we are already confronted with the problems that embrace the Old Prussian Hussar Sabre!

Let us start with the weapon itself. Today no one can say which sabre was the first to see service with the Prussian Hussars.

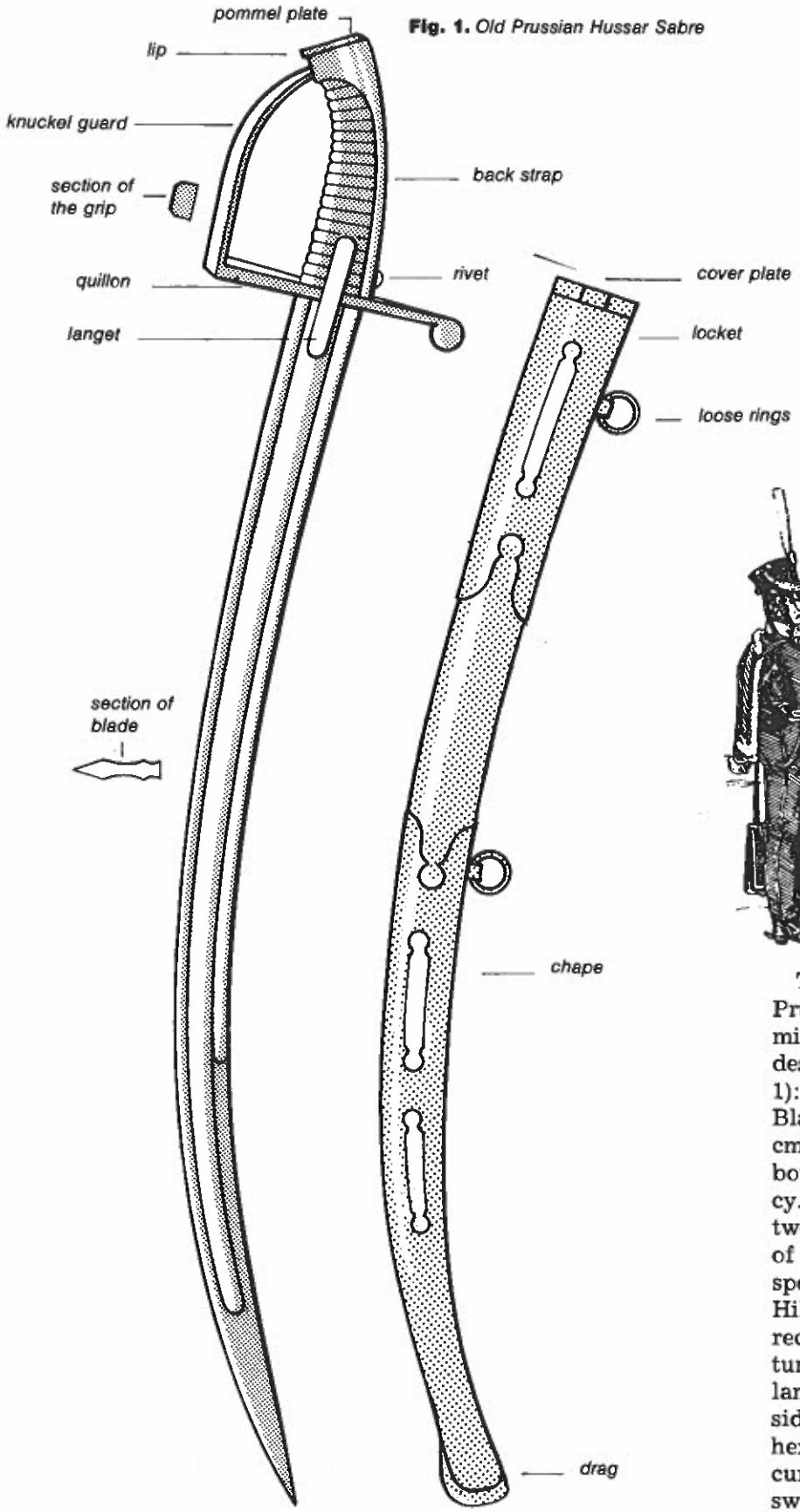


Fig. 1. *Old Prussian Hussar Sabre*

The sabre worn by the Prussian Hussars in the mid-18th century can be described as follows (Fig. 1):

Blade: 90 – 93 long, 3.7 – 3.8 cm (max.) wide, fullered on both sides à la Montmorency. False edge measures between 25 and 28 cm. Height of camber c. 5.5 cm. Point: spear-like.

Hilt: Straight quillon with rectangular profile, down-turned end knob, brazed langets (7 – 8 cm) on both sides. Knuckle guard is hexagonal in cross section, curved at the top, and sweeps up at a right angle to

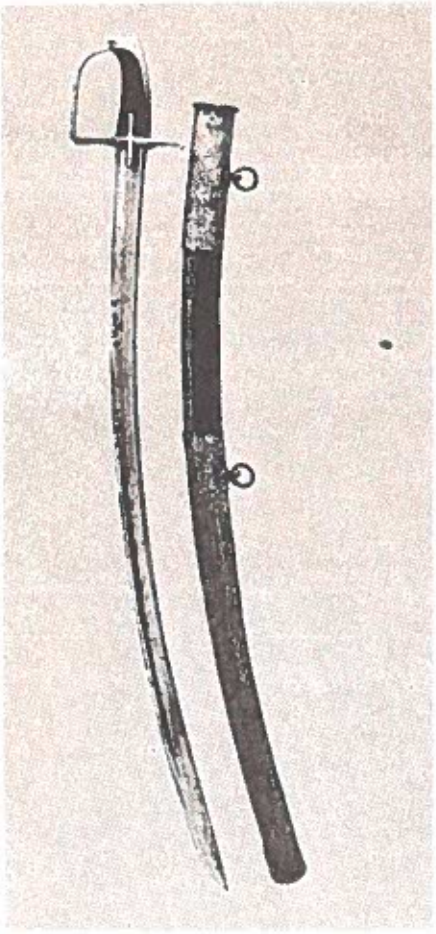


Fig. 2. *See text*

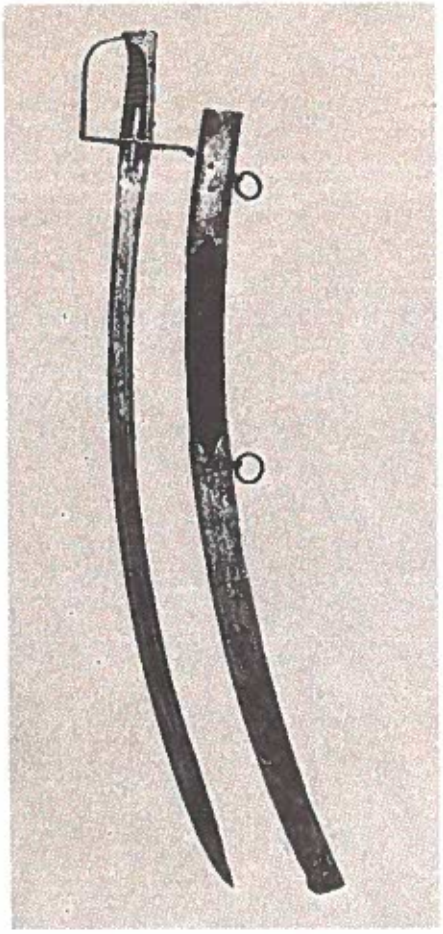


Fig. 3. *See text*

the pommel. The back plate is either held by a rivet, driven into the wooden grip horizontally, or by a spike that fits vertically into the quillon. To crown this, a slightly off-set pommel plate is brazed at the top of the hilt. The wooden grip is covered with black leather and bound with cord. All parts of the hilt are of iron.

However, sabres conforming to this description are not necessarily Old Prussian Hussar Sabres. Only the factory stamp, monogram, or other etching can provide clues to the sword's true history.

The scabbard of the Prussian Hussar Sabre is not simple to describe, for apparently there existed a number of different versions. Still, its general design is known.

Its frame, made of wood, was covered with black leather (brown according to Gohlke and Eckardt-Morawietz). The chape and locket were of iron. The collars for the two rings were brazed. Issue No. 4 of the "Archiv für Waffen- und Uniformkunde," (1918) states that the first Prussian Hussar Sabres had loose rings mounted on the convex side of the scabbard, à la Old Slav tradition.

According to Deiss, the Hussar sabres that were still in use in 1809 were put into iron scabbards.

When comparing illustrations in "Die Handwaffen des brandenburgisch-preussisch-deutschen Heeres" (Eckardt-Morawietz) there is one type of scabbard that is more common than the rest, the model reproduced in Fig. 1. However, without a doubt other types of scabbard existed, especially those with locket and chape lacking the lengthwise breakthroughs.

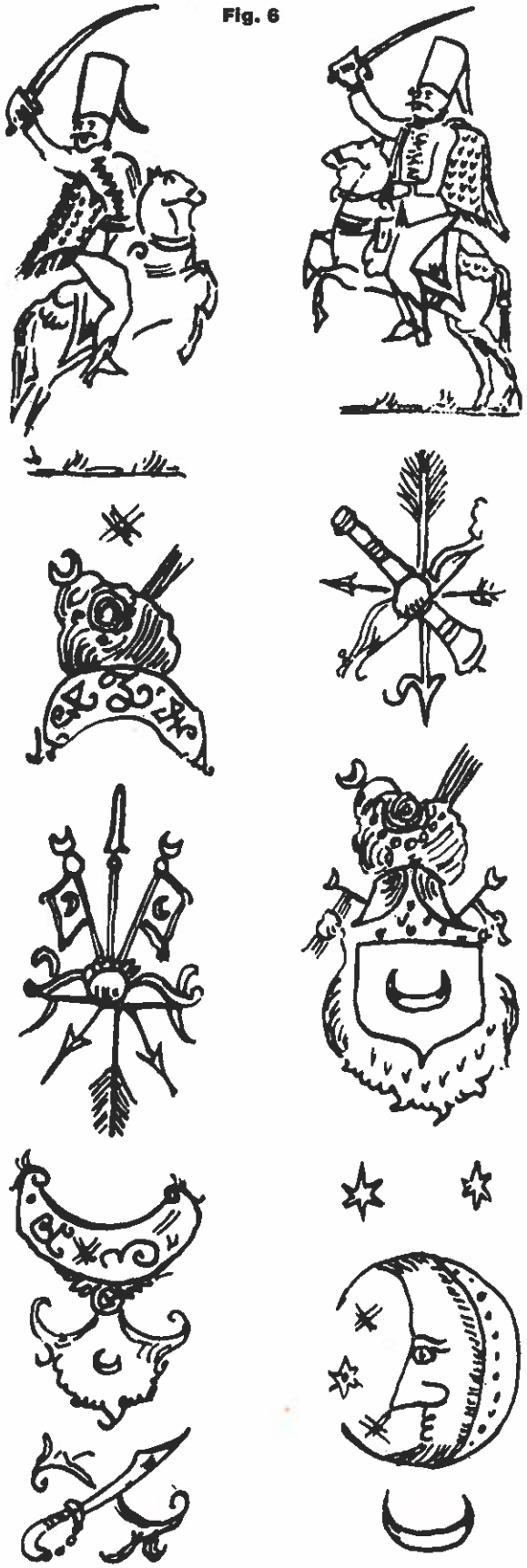
There is a disagreement in opinion on the "character" of the officer's sword. Gohlke, in "Die blanken Waffen," says: "The sabre of the Hussar officer had the standard shape, the blade was adorned with emblems or with the figure of a Hussar. It also bore the legend 'Vivat Hussar' and the signature of the king."

Eckardt-Morawietz, in his above-mentioned book, writes: "The officers wore the same type of daggers and swords as the men, but usually adorned with etchings, gold and precious furniture."

Deiss, in "Blank- und Schutzwaffen Preussens vom 18. Jahrhundert ab," reports: "The officers carried the same swords as the men, although the hilt and scabbard were of better quality and superbly decorated. Some were of pure silver."

Wagner, in "Hieb- und Stichwaffen," relates that the officer's scabbard was

Fig. 6



encased in gold-plated brass, when referring to models between 1758 and 1764. This is the model in Fig. 1.

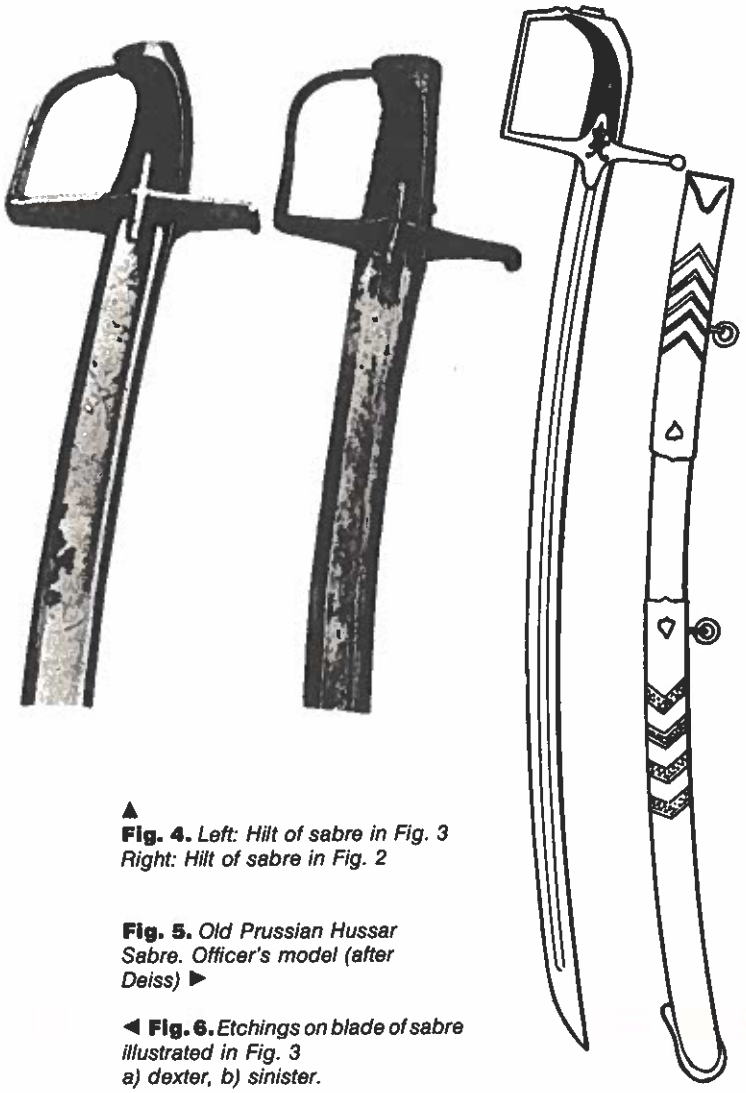
We do not know exactly of what materials hilts and scabbard adjuncts were made of, as the experts disagree among themselves, but the author believes that the Hussar sabre under discussion was of iron, and "white mounted," although "yellow mountings" were likely alternatives.

It would be interesting to learn from readers whether the Old Prussian Hussar Sabre existed with brass mountings, and where such pieces are today.

I have come to the sad conclusion that too little is known about this sabre. We are acquainted with its basic form, but know hardly anything of the variants and their dates of introduction.

At this point I want to describe two sabres that are in all probability genuine Old Prussian.

The sabre in Fig. 2 is rather crude in finish. The blade is 90.5 cm by 3.6 cm (max.), and the course of the



▲ **Fig. 4.** *Left: Hilt of sabre in Fig. 3 Right: Hilt of sabre in Fig. 2*

Fig. 5. *Old Prussian Hussar Sabre. Officer's model (after Deiss)* ▶

◀ **Fig. 6.** *Etchings on blade of sabre illustrated in Fig. 3 a) dexter, b) sinister.*

▲ *Friedrich II at the Battle of Rossbach. Original painted by Schadow*

fullers is very irregular. The edge is nicked and jagged at places, but still exceedingly sharp. The grip tilts slightly to the front (cf. Fig. 4) and the lip of the pommel plate is missing. It might have been filed down. The blade bears a sceptre and the word POTSDAM. From this one might conclude that this sabre was made at the Arms Factory in Potsdam.

The scabbard, covered in black leather, deviates from that depicted in Fig. 1 in that locket and chape are void of break-throughs. Furthermore, the cover plate of the locket is missing.

The sabre in Fig. 3, apart from rough solderings on the scabbard, is a piece of excellent handwork. Iron parts are polished. The blade, 91.5 by 3.8 cm (max.) is also beautifully polished but, unfortunately, does show a few spots of rust. The grip is tilted to the front (cf. Fig. 4) and a rivet head protrudes from the pommel plate. The locket and chape of this scabbard also lack break-throughs. The middle section, covered in black leather, is reinforced at front and back edges through rails. The initials "SM" are on the quillon and tang, which without a doubt represent the name of the bladesmith. The flat, back edge of the sabre bears an illegible etching (the etcher's initials?) and the word SOHLINGEN. This would make one believe that the blade is a product of this famous cutlery town. The initials "SM" might have stood for Samuel Mertens or Samuel Mum, two renowned bladesmiths of that era. Cronau, in "Geschichte der Solinger Klingenindustrie" informs us that these two master craftsmen were active during the 1860s. However, the etchings in Fig. 6 are the most interesting feature of this weapon.

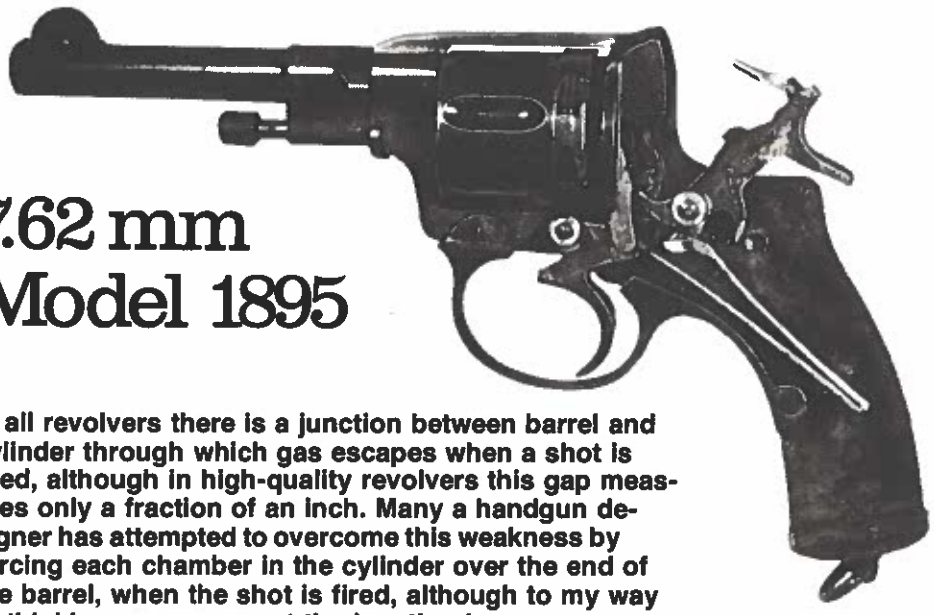
In addition to half moons, weapon trophies and cabalistic-astrological signs, Hussars are depicted on both sides of the blade, wearing what looks like panther-skin tunics. Clothing of panther skin was regarded a first-class honour by the officers of the Zieten Hussars. We must assume, therefore, that this sabre once belonged to an officer of that well-known regiment.

1

Text and Photos E. Brunnthaler

Nagant Gas Check Revolver

7.62 mm Model 1895



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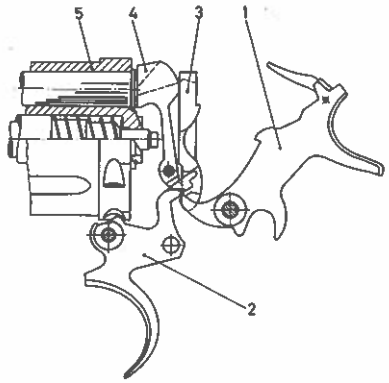
3

In all revolvers there is a junction between barrel and cylinder through which gas escapes when a shot is fired, although in high-quality revolvers this gap measures only a fraction of an inch. Many a handgun designer has attempted to overcome this weakness by forcing each chamber in the cylinder over the end of the barrel, when the shot is fired, although to my way of thinking gas escape at the junction is more a theoretical than practical disadvantage.

The best known and most successful of the gas check revolvers was undoubtedly the Nagant 1895 in calibre 7.62 mm (.30), which was adopted by the Russian armed forces. Nagant, by the way, was a Belgian, not a Russian, who lived in Liege. The Nagant was initially manufactured in Belgium, but later in great numbers at the Tula Arsenal in Russia. Quality was exceptionally good, although trigger pull was usually stiff, which must be put down to the design of the cylinder mechanism. This revolver saw service in World War II, virtually in its original form. However, enlisted men were issued with a single-action version, whereas the officers' model was double action. A third model was also produced with a short barrel and short handle, but not many of these left the production lines.



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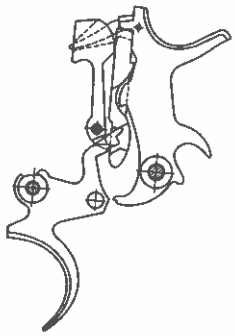

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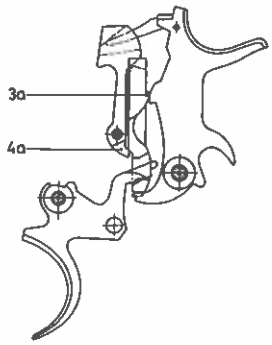

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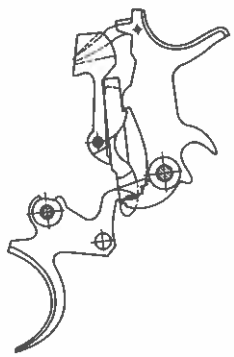

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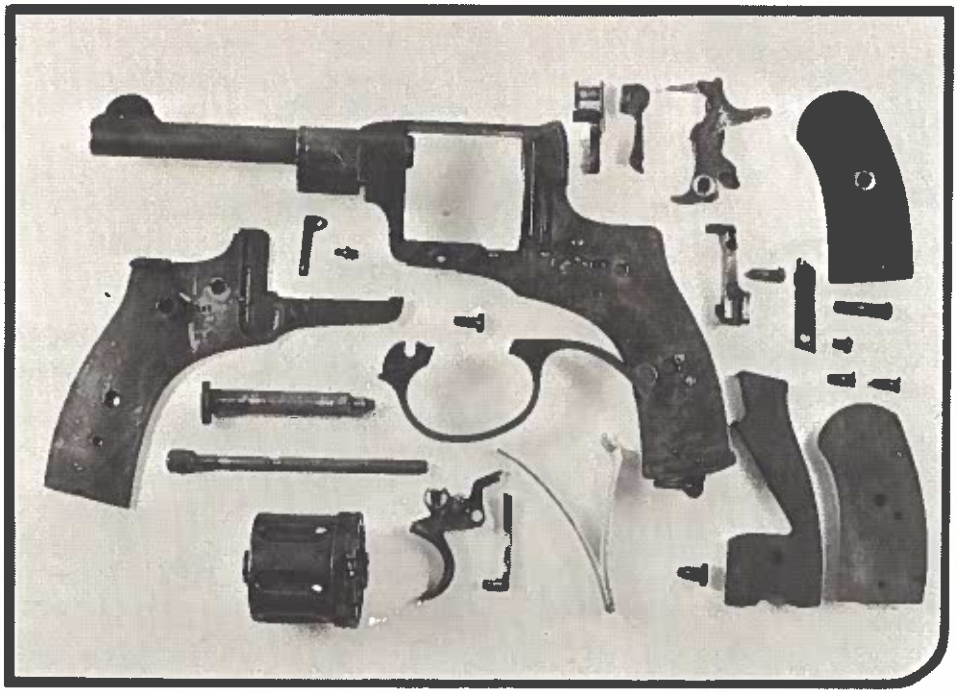
The gas check between cylinder and barrel is achieved when the hammer is cocked. Just before the hammer reaches full cock, but after the cylinder has rotated the distance of one chamber, the pawl thrusts the cylinder forward so that the hollowed out face of the cylinder (Fig. 3) engages over the end of the barrel. The Nagant cartridge protrudes .066 in. from the front of the cylinder, so when the cylinder goes forward the nose of the cartridge enters the barrel a short distance, thus minimizing gas escape.

That is why the Nagant cartridge case extends about .039 in. beyond the nose of the bullet. The case is necked in front of the bullet; however, this necking is expanded by the bullet once the charge has been ignited Fig. 1 shows two of these bottleneck cartridges, alongside the revolver. Fig. 2 depicts the Nagant with sideplate removed. The two wooden stocks, and a wooden centre piece, are fastened to the frame and to the sideplate. When dismantling the Nagant, the screw on the right side must first be removed, in order to lift off the left sideplate. The trigger guard is screwed to the frame at the front, but hooked at the back. Both hammer and trigger are actuated by the two-pronged mainspring.

Close to the hammer a tapped blind hole has been cut into which fits the screw that unites the left sideplate with the frame. If, for example, the hammer is to be taken down, but the mainspring left in, the screw can be screwed into the blind hole when the hammer is cocked. Once the hammer is lowered it can be lifted out of its frame, since the mainspring has been clamped back out of action, by the aforementioned screw.

If the cylinder is to be removed, the knurled head of the ejector rod must be rotated a half turn counter-clockwise, and the ejector rod pulled out as far as it will go. This rod is mounted on a movable arm attached to the barrel, permitting it to be swung to the right to align with the chamber. The cylinder must be rotated one chamber at a time, and the ejector pushed and pulled to oust each empty case individually. This is an antiquated system, and must be regarded as one of the chief weaknesses of the Nagant. The actual cylinder pin is provided with a small plate at its front end, which extends slightly from the frame on both sides. The bushing of the ejector rod locks the cylinder pin when the ejector rod is in its home (firing) or out (unloading) positions.

Before the cylinder can be taken out of the frame, the bushing of the ejector rod must be turned to coincide with a mark on the barrel. Only then can the cylinder pin be drawn out, and the cylinder removed from the right of the frame. The axial movement of the cylinder is illustrated in Figs. 4 to 7. When the hammer (1) is thumbed back, the trigger (2) moves back, too, which in turn lifts the pawl (3). This pawl slides up and down in a vertical groove in the receiver. When the pawl rises, the resistance block (4) presses against the cylinder (5) and pushes it far enough for-



8

Main Specifications

Calibre	7.62 mm (.30)
Rifling	4 grooves, right-hand twist
Barrel length	4.5 in.
Overall length	9.2 in.
Diameter of cylinder	1.59 in.
Chambers	7
Weight (empty)	1.7 lbs.

ward to join up with the barrel. Fig. 5 shows the hammer down but resting against the pawl, as the trigger has not been released. The shot, of course, has been fired, and both resistance block and pawl help buffer the recoil. When finger pressure on the trigger is relieved, the pawl moves downwards and the resistance block, via the appendage 4a, is retracted, whereby a spring that is accommodated in the shaft of the cylinder presses the cylinder away from the barrel. The hammer rebounds when the pawl, in its downward movement, strikes the protrustion 3a on the front edge of the hammer. Hence, the hammer is then out of reach of the other cartridges in the cylinder. Fig. 6 illustrates the functioning of the rebounding hammer. In Fig. 7 the hammer is at rest, whereby the resistance block lies squarely against the pawl, and the hammer, engaged in the lip of the pawl, also blocks the trigger in the case of a single-action mechanism. As said before, these pushing and lifting contrivances give rise to a stiff lockwork. If the parts are carefully polished though, a marginal change for the better is possible. Still, the Nagant was ingeniously conceived, there is no doubt about that, when one considers the state of technology at the turn of the century.

Just above the stock on the left side of the frame is the name of the manufacturer, place and year of production in the Cyrillic alphabet. The model described here was made in 1903.

All functional parts bear a check mark, that is, a small T-shaped hammer. Hammer and trigger are blued, the frame has a brown finish. The butt is crowned with a non-swivelling lanyard ring. Fig. 8 shows the Nagant completely stripped.

Text and Photos
K. D. Meyer

1 *The Russian SKS, right view. It is more or less a scaled-down version of the PTRS anti-tank rifle.*

The Russian SIMONOV CARBINE (SKS)

The SKS was a successful Russian post-war military rifle development. Like the AK 47 (Avtomat Kalashnikov) that was introduced a little later, the SKS was chambered for the Russian short cartridge, Mod. 43. Acclaimed for its manageability and rugged construction, the SKS was adopted as an official weapon by the Soviet Bloc countries following WW II. Though, as far as we know, the SKS is no longer being produced, it is still occasionally seen in Russia, East Germany, Poland, Czechoslovakia, Hungary and Bulgaria.

SKS is an abbreviation for Ssamosarjadnyi Karabin Simonov, and simply means: Selfloading Carbine Simonov. Apparently it is a Russian peculiarity to honor their inventors in this way.

Sergei Gavrilovich Simonov can be mentioned in the same breath with Federov, Degtyarev, Tokarev and Shpagin. Simonov was conferred many high awards by the Soviet Union for his work in firearms design.

Simonov was born in 1894 in Fedotov, near Ivanovo-Vosnessensk and, after elementary school, he worked in a foundry. Later at a machine factory he became acquainted with technical drawings and machine tools. He was so fascinated by the world of engineering that he enrolled in technical courses, and educated himself by reading everything he could lay his hands on. By 1918 Simonov had advanced to a qualified mechanic, and he found work in an arms factory that was directed by Federov and Degtyarev. Once his superiors realized his capabilities and his interest in firearms, they entrusted him with the final inspection of automatic rifles. But he was not content with this work for very long.

He wanted to do a bit of designing himself. To begin with, he proposed minor improvements for various gun parts, then he devised schemes for simplifying production methods. In 1919 he became a designer in a larger gun factory and later he headed an experimental station. In 1926 he designed a light machine gun, and about 1930 he produced the AVS, a selfloading rifle that could be switched to fire fully automatically. The AVS was adopted by the Red Army in 1936. However, the Tokarev rifle proved to be more reliable. Still, Simonov's next invention, the

2 *The SKS, left view, with tucked in bayonet. German sentries at East Berlin's cenotaph were recently seen still armed with this version.*

semi-automatic PTRS anti-tank rifle, was particularly successful in WW II. A little later the SKS appeared, together with the 7.62x39 mm (Mod. 43) cartridge. Since the Russians dislike forsaking well-tried principles, it is not surprising to find that the SKS is virtually nothing more than a scaled-down version of the PTRS anti-tank rifle.

The SKS is semi-automatic, gas operated, and is locked by a tilting block. Its breech bolt design strongly resembles that of the German assault rifle StG 44. The gas port is situated in the forward third of the barrel, in the upper wall. A gas regulator was not provided. The escaping gases were bled back to the piston via the return conduit mounted over the barrel. The piston was chromium plated to ward off rust and erosion. The gas cylinder, in which the piston and piston rod reciprocate, abuts against the return conduit at its front end, and against the rear sight base at its rear end. The piston rod does not directly contact the bolt carrier, but rather against a transmission block that lies in the sight base.

The SKS receiver is box-shaped and contains the breech bolt, carrier, trigger mechanism and the magazine. Breech bolt and carrier are two separate units, joined together on inclined planes. The action is locked by tilting down the breech bolt.

3

3 *Sergei Gavrilovich Simonov, father of the SKS, was born in Fedotov in 1894.*

4 *Cross section of the SKS. Firing mechanism is at rest, the breech bolt locked, the magazine empty. Bayonet is ready for action.*

5 *The SKS fully stripped. No tools are required, except the point of a bullet.*

6 *In 1930 Simonov designed the rapid-fire "Avtomat," which the Red Army tested in 1936 as the AVS 36.*

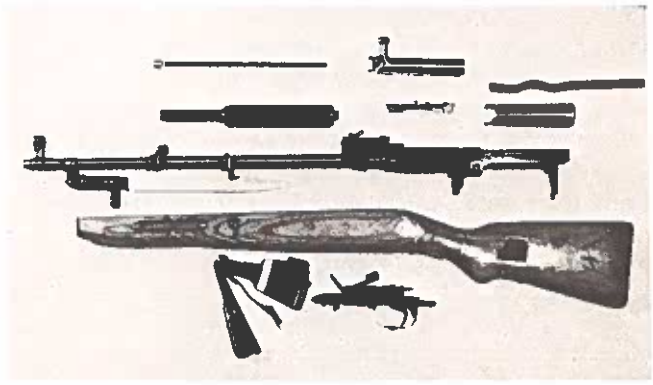
7 *Breech bolt and carrier.*

8 *The receiver is box-shaped and milled from solid stock. Note the cocked hammer.*

9 *Breech bolt in locked position. An inclined plane of the carrier presses the rear end of the bolt downwards. The bottom ledge of the bolt then rests against a hardened abutment in the receiver ring.*

10 *Breech bolt unlocked. After the carrier has moved a fraction of an inch rearwards it lifts the bolt out of the locked position. Both parts then travel back in unison.*

4



5

6

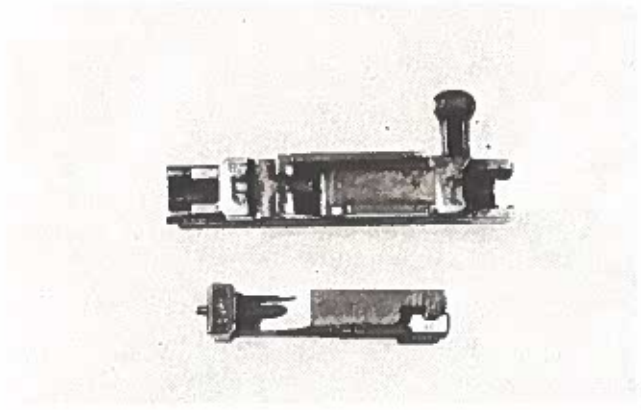
Its rear edge rests on a hardened abutment in the receiver. Following common practice, the breech bolt houses the firing pin, and is provided with a powerful extractor. The operating handle protrudes from the carrier on the right-hand side. This carrier is supported by the action spring, the rear end of which is anchored against the back plate of the receiver housing. A cover plate closes in the rear section of the receiver. This cover plate slides in a groove in the receiver housing and is cross bolted in position. The broached rifling has four grooves that are approximately as wide as the lands. Strangely enough, the firing chamber and bore are chromed lined. This is indeed expensive treatment for an East-bloc firearm. Ordinarily, chrome lining is reserved for automatic weapons and high-class sporting rifles. A chrome-lined MG barrel, subjected to heat in the region of 750° to 930° F, has double the service life of a normal barrel. The SKS fires a relatively weak round, so the cost of chrome lining and the advantage this lining offers just don't tally.

The front sight is of the post type, and the U rear sight is adjustable for elevation and windage. The base for the hooded front sight is attached to a barrel band, which, in turn, carries the bayonet stud. The rear sight is adjusted along an inclined plane, and is graduated up to 1100 yards in 110 yard increments. A Russian speciality is the so-called "combat sighting" position, which is marked by an A in Russian weapons, and by SV in East German weapons! Communist soldiers are instructed to aim at the bottom line of the target up to 330 yards, and at the top line of the target beyond 330 yards, when the sight is set at the combat position. Since today the infantry closes in to between 110 and 330 yards when engaged in battle, this "universal" sight graduation is just right for the purpose: No more diverting one's attention from the enemy through fumbling around with distance and sight graduations. Line of sight is about 3/4 in. over the barrel, as the cylinder and hand guard are over the barrel too.

The magazine is integral with the rifle itself, and holds 10 rounds in staggered formation. The SKS is clip or individually loaded through the top of the receiver. To unload this rifle, the magazine catch is actuated to let the magazine pivot out around its forward axle pin. The cartridges will then drop out.

The firing and trigger mechanism is mounted as a unit on the trigger plate, and consists of hammer and spring, trigger and trigger bar, recoil spring, disconnector and a check lever that prevents a shot being prematurely fired, that is, before the action is properly closed and locked. The safety catch is behind the trigger, and can only be applied when the rifle is

7



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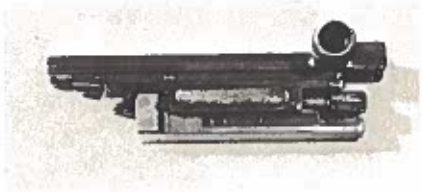

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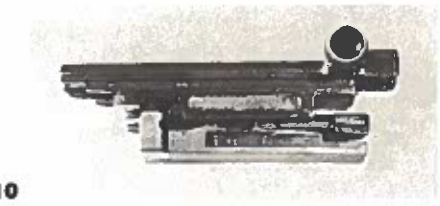
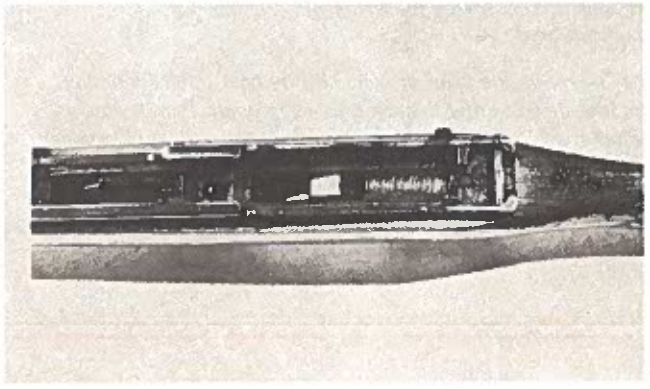


11 *To unload the SKS, the magazine can be swung down on its axle pin. The cartridges then fall out.*



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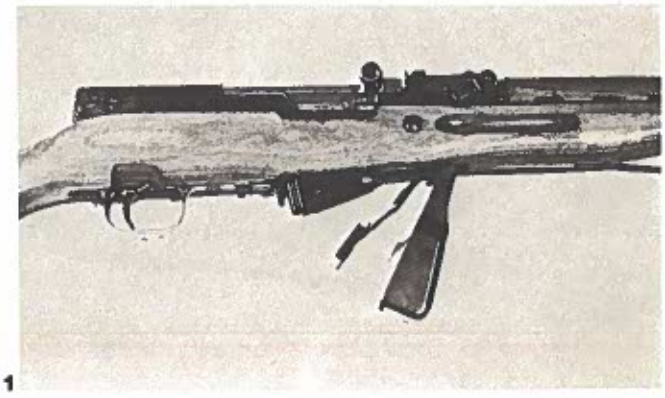


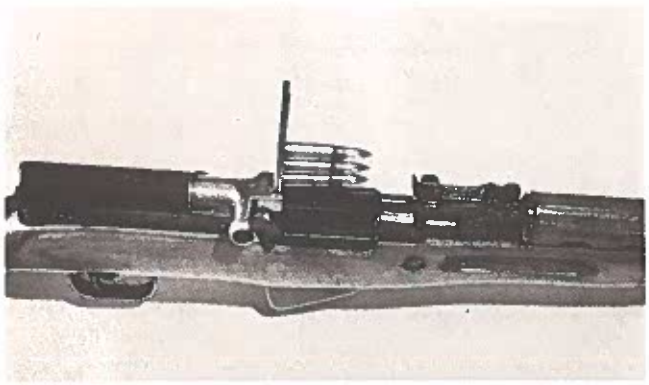
11

SIMONOV CARBINE

cocked. It blocks the trigger. The stock is made of laminated wood, and is lacquered. A slot in the buttstock supports the rear end of the sling. A sheet metal buttplate is the only piece of furniture on the SKS. Just in front of the magazine, a cross bolt passes from one side of the weapon to the other. The idea here is to transfer recoil energy to the stock. As was customary at the time, the SKS was also produced as a thrust weapon with a folding bayonet that turned back under the barrel when not in use. Two types of these bayonets are known: the first is the usual knife pattern, the second, which is rare, is a pig-sticker type of bayonet that resembles that of the Moisin-Nagant Carbine. Today the bayonet is becoming a relic of the past, of course; but the SKS, it must be remembered, was conceived about 1945. All the more wondrous, therefore, that this rifle has appeared in Korea, in Cuba, and in the Sinai peninsula where the Israelis found it alongside a pair of Arab shoes. Red China is so enthralled by this old timer that it has been adopted as a standard piece of equipment and is known in China as the Type 56. Slightly modified, the Chinese SKS is produced in Mao's country where no one dare claim that this rifle isn't a great Chinese invention, let alone affirm that it has been copied from the Russians ...

In summary, the SKS is a healthy design, it is sim-

12



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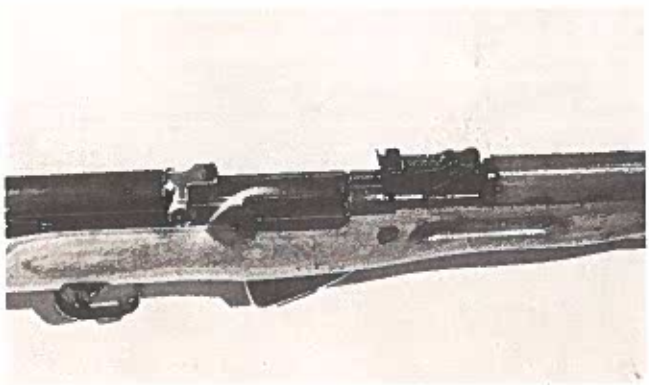

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12 *The 10-shot magazine is ordinarily clip loaded, as depicted here.*

13 *The magazine follower plate lifts the hold-open latch after the last shot, in order to keep the action open. This device is unfortunately missing on a number of modern military longarms.*

14 *The bayonet can be locked in the forward position, or folded back under the barrel when not in use.*

ple in concept, rugged in construction, and absolutely reliable in the tropics or the cold of the Arctic winter. Here is the reason why the Ssamosarjadnyi Karabin Simonov refuses to fall into oblivion.

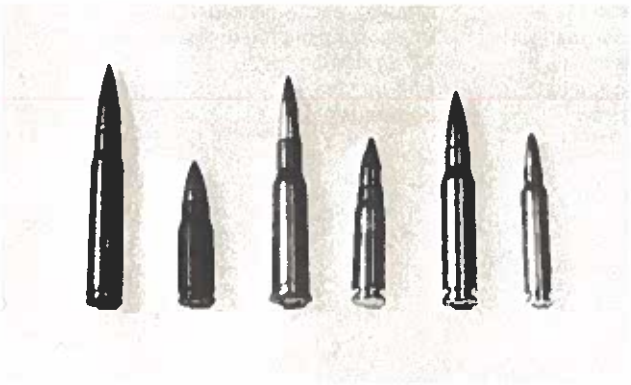
Stripping

After shooting, the barrel is ordinarily wiped out with a patch. In order to clean the barrel from the chamber end, the breech bolt has to be removed. To this end, the cover plate lever that is mounted on the receiver ring is swung up 90 degrees, and pulled out to the right, until it stops. The cover plate can then be slipped back about 3/4 in., and lifted off the receiver. The end of the cover plate simultaneously being an abutment for the action or recoil spring, this spring and its guide are also removed. The carrier is pushed back and lifted out of its recess together with the breech bolt.

When a lot of shooting has been done, the gas system should be cleaned as well. The take-down lever for the gas cylinder is situated on the right side of the rear-sight base. When pressed up about 90 degrees, against light spring tension, this lever releases the hand guard around the gas cylinder. By pointing the rifle downwards, the piston will freely drop out of the cylinder housing. Just remove residual powder but do not oil! If oil is used in the cylinder, the SKS will probably jam.

Should it be necessary to take off the stock, or to inspect the firing mechanism, then place the point of a bullet in the hole behind the trigger guard. Slight pressure towards the muzzle will release the whole trigger assembly and magazine. It is now necessary to fold the bayonet forward to its "working" position, to get a grip on the barrel to heave it from the stock! Further dismantling should not be necessary.

15



15 *The following cartridges illustrate differences in size. Left to right: German ex-military 8x57 IS, German short 8x33 for the assault rifle StG 44, Russian 7.62x54 R Moisin-Nagant, Russian short 7.62x39 (M 43) for SKS and Kalashnikov, NATO 7.62x51, American intermediate .223 for M 16.*

16

16 *Russian 7.62x39 cartridges for western consumption. Regretably, they use the Berdan primer, hence reloading is a little troublesome.*

SIMONOV CARBINE

Technical data

I. Rifle

Description	Selfloading carbine (Ssamosarjadnyi Karabin Simonov), or SKS
Manufacturer	Various arsenals in East Bloc and Red China
Calibre	7.62 x 39 (M 43)
Action	Gas operated
Rate of fire	For practical purposes about 30 shots a minute
Lock	Tilting wedge
Ignition mechanism	Internal hammer
Safety	Blocks trigger
Trigger	Two-stage military type
Barrel	Broached rifling (4 grooves), chrome lined
Barrel length	20.4 in.
Sighting	Post and U rear sight, graduated from 110 to 1100 yds.
Sight radius	19 inches
Magazine	Box type
Capacity	10 rounds
Overall length: with knife bayonet	49.6 inches
with pig sticker	52.2 inches
Weight: with knife bayonet	8 lbs 8 oz. (magazine empty)
with pig sticker	8 lbs 3 oz. (magazine empty)

II. Cartridge

Description	M 43 (7.62 x 39)
Manufacturers	East Block, Red China, Finland
Length	55.6 mm (2.19 in.)
Weight	255 grains
Charge	Nitrocellulose powder
Load	21.6 grains
Muzzle velocity	2411 fps
Muzzle energy	1555 ft. lbs.
Bullet's shape	Full metal case, pointed
Types	PS with soft iron core (no color code), T–45 tracer (green tip) BZ hard core incendiary (black and red point) Z incendiary-tracer (red point)
Bullet weight	122 grains
Bullet length	1 inch
Case	Rimless, bottle-necked
Case material	Brass; copper-plated steel
Case weight	107 grains
Case length	1.52 inches
Primer	Berdan type

Conversion Tables

1 cubic inch = 16.387 cubic centimetres.
1 pint = 0.5682 litre.
1 foot per second = 0.3048 metre per second.
1 ton per square inch = 157.49 kilo. per square centimetre.
1 foot-pound = 0.1382 kilogram-metre.
1 square centimetre = 0.155 square inch.
1 cubic centimetre = 0.061024 cubic inch.
1 litre = 1.76 pints.
1 metre per second = 3.2808 feet per second.
1 kilo. per square centimetre = 0.00635 ton per square inch.
1 kilogrammetre = 7.233 foot-pounds.
1 dram = 27.34 grains.
1 dram = 1.771 grammes.
1 drachm = 60 grains.
16 drams = 1 ounce.

Comparative Table of Dimensions

in "Millimetres" and "Inches," with their respective parts

Millimetres (mm)	Inches (")	Millimetres (mm)	Inches (")	Millimetres (mm)	Inches (")
1	.039	.1	.004	.01	.00039
2	.079	.2	.008	.02	.00079
3	.118	.3	.012	.03	.00118
4	.157	.4	.016	.04	.00157
5	.197	.5	.020	.05	.00197
6	.236	.6	.024	.06	.00236
7	.276	.7	.028	.07	.00276
8	.315	.8	.031	.08	.00315
9	.354	.9	.035	.09	.00354
10	.394	1.0	.039	.10	.00394
11	.433	1.1	.043	.11	.00433
12	.472	1.2	.047	.12	.00472
13	.512	1.3	.051	.13	.00512
14	.551	1.4	.055	.14	.00551
15	.591	1.5	.059	.15	.00591
16	.630	1.6	.063	.16	.00630
17	.669	1.7	.067	.17	.00669
18	.709	1.8	.071	.18	.00709
19	.748	1.9	.075	.19	.00748
20	.787	2.0	.079	.20	.00787

Comparison of American and Metric Units

LENGTH
1 inch = 25.4 millimetres.
1 foot = 0.3048 metre.
1 mile = 1.6093 kilometre.
1 millimetre = 0.0394 inch.
1 metre = 3.2808 feet.
1 kilometre = 0.6214 mile.

WEIGHT
1 grain = 0.0648 gramme.
1 oz. (avdp.) = 28.35 grammes.
1 lb. = 0.4536 kilogramme.
1 ton = 1016 kilogrammes.
1 gramme = 15.432 grains.
1 gramme = 0.0353 oz. (avdp.)
1 kilogramme = 2.2046 lbs.
1000 kilogrammes = 0.9842 ton.

VARIOUS
1 square inch = 6.4516 square centimetres.

Comparative Table of Weights

in "Grammes" (g) and "Grains" (gr) with their respective parts.

Grammes = g	.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
1	15.4	16.9	18.5	20.1	21.6	23.1	24.7	26.2	27.8	29.3
2	30.9	32.4	34.0	35.5	37.0	38.6	40.1	41.7	43.2	44.8
3	46.3	47.8	49.4	50.9	52.5	54.0	55.6	57.1	58.6	60.2
4	61.7	63.3	64.8	66.4	67.9	69.4	71.0	72.5	74.1	75.6
5	72.2	78.7	80.2	81.8	83.3	84.9	86.4	88.0	89.5	91.0
6	92.6	94.1	95.7	97.2	98.8	100.3	101.9	103.4	104.9	106.5
7	108.0	109.6	111.1	112.7	114.2	115.7	117.3	118.8	120.4	121.9
8	123.5	125.0	126.5	128.1	129.6	131.2	132.7	134.3	135.8	137.3
9	138.9	140.4	142.0	143.5	145.1	146.6	148.1	149.7	151.2	152.8
10	154.3	155.9	157.4	159.0	160.5	162.0	163.6	165.1	166.7	168.2
11	169.8	171.3	172.8	174.4	175.9	177.5	179.0	180.6	182.1	183.6
12	185.2	186.7	188.3	189.8	191.4	192.9	194.4	196.0	197.5	199.1
13	200.6	202.2	203.7	205.2	206.8	208.3	209.9	211.4	213.0	214.5
14	216.0	217.6	219.1	220.7	222.2	223.8	225.3	226.9	228.4	229.9
15	231.0	233.0	234.6	236.1	237.7	239.2	240.7	242.3	243.8	245.4
16	246.9	248.5	250.0	251.5	253.1	254.6	256.2	257.7	259.3	260.8
17	262.3	263.9	265.4	267.0	268.5	270.1	271.6	273.1	274.7	276.2
18	277.8	279.3	280.9	282.4	283.9	285.5	287.0	288.6	290.1	291.7
19	293.2	294.8	296.3	297.8	299.4	300.9	302.5	304.0	305.6	307.1
20	308.6	310.2	311.7	313.3	314.8	316.4	317.9	319.4	321.0	322.5
21	324.1	325.6	327.2	328.7	330.2	331.8	333.3	334.9	336.4	338.0
22	339.5	341.0	342.6	344.1	345.7	347.2	348.8	350.3	351.9	353.4
23	354.9	356.5	358.0	359.6	361.1	362.7	364.2	365.7	367.3	368.8
24	370.4	371.9	373.5	375.0	376.5	378.1	379.6	381.2	382.7	384.3
25	385.8	387.3	388.9	390.4	392.0	393.5	395.1	396.6	398.1	399.7
26	401.2	402.8	404.3	405.9	407.4	408.9	410.5	412.0	413.6	415.0
27	416.7	418.2	419.8	421.3	422.8	424.4	425.9	427.5	429.0	430.6
28	432.1	433.6	435.2	436.7	438.3	439.8	441.4	442.9	444.4	446.0
29	447.5	449.1	450.6	452.2	453.7	455.2	456.8	458.3	459.9	461.4
30	463.0	464.5	466.0	467.6	469.1	470.7	472.2	473.8	475.3	476.8